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Suggestions regarding forest administration in the Central Provinces.

by D.Brandis.

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SUGGESTIONS

REGARDING

FOREST ADMINISTRATION

IN THE

CENTRAL PROVINCES.

BY

D. BRANDIS, F.R.S.,

INSPECTOR-GENERAL OF FORESTS TO THE GOVERNMENT OF INDIA

Dated Amballa, 17th April 1876.

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SUGGESTIONS

REGARDING

FOREST ADMINISTRATION

IN THE

CENTRAL PROVINCES.

Dated Amballa, 17th April 1876.

INTRODUCTION.

I ARRIVED at Jabalpur on the 1st February 1876 and started on my tour of inspection on the 4th February, marching *viâ* Seoni to the Satpura reserve, which I examined from the 14th to the 17th February. Thence I made for the Pandratola reserve on the Wainganga river (18th February), and went on *viâ* Mohgaon, Parswarra, and Sareka to the sál forests of the Maikal range, to which the time from the 22nd to the 28th February was devoted. From the sál forests we went *viâ* Motinalla and Biehia to the Jagmandal reserve, and thence *viâ* Ramnagar to Mandla, which place we reached on the 2nd March. From Mandla we went through the Barela forest (6th and 7th March) to Jabalpur and thence to the Singrampur reserve in the Damoh district (11th to 13th March), and from Singrampur across *viâ* Baheroban and Bilheri to the Bijerághogarh sál forests, which we examined from the 19th to the 22nd March. At Moorwara I took the train for Allahabad on the 25th March and left the Central Provinces. I have thus examined on this tour the principal reserves in the Seoni, Balaghat, Mandla, Damoh and Jabalpur districts. The examination of the reserves of the southern and western districts, Chánda, Wardha, Betúl, Nimar, and Hoshangabad has been left for another season. During the whole of the time I was accompanied by Mr. A. Smythies, Assistant Conservator of Forests, and am much indebted to him for assistance rendered me in drawing up the present report. Mr. Jacob accompanied me through the Satpura reserve; Captain Losack through the sál forests of Mandla and Balaghát and the Jagmandal reserve. Captain Doveton, the Conservator, was with me from the 22nd February to 10th March, and from the 18th to the 23rd March. I desire to record my obligations to these officers for the assistance rendered and the valuable information and advice given me on this tour.

Forests visited.

2. The main portion of the present report will necessarily relate to the reserves. Before, however, entering upon the detailed remarks concerning each reserve visited by me, I beg to submit a few suggestions of a general character. In the districts which I have examined the work of demarcating reserves is not yet completed, and, as a matter of fact, it is contemplated to select and demarcate additional areas as reserves. It is true that the forests already demarcated in these districts comprise considerable areas, but these reserves are almost without exception in remote localities and at a considerable distance from the principal centres of consumption and from what have hitherto served as the main lines of communication; moreover, with the sole exception of the Banjar forest, the present reserves are extremely poor in mature timber and in other marketable material. The following is a statement of the total area of the districts in ques-

Additional reserves proposed.

tion with the area of the present reserved and unreserved forests as they stood at the close of 1874-75 :—

District.	Area in square miles.			Percentage of reserves to total area of district.
	District.	Unreserved forest.	Reserves.	
1. Jabalpur	3,918	328	33	0·84
2. Damoh	2,799	858	10	0·35
3. Seoni	3,053	749	210	6·87
4. Balaghát	3,141	1,067	250	7·95
5. Mandla	4,719	2,293	113	2·39

It is obvious that the proportion of reserves to total area is very small, and that on this account also an extension of the reserves is desirable.

The unreserved forests must not be regarded as permanent sources of forest produce.

3. On one point I have satisfied myself thoroughly on this tour, that in the districts visited the unreserved forests must not be reckoned upon to furnish the country permanently with wood, bamboos, grass and other forest produce. To begin with, the area of the excess waste designated as unreserved forest has not been maintained intact. Large areas have been brought under permanent cultivation, and the forest left is often limited to stretches of stony and poor soil. As an illustration of this remark, I beg reference to the extract from my journal in the appendix, which gives an account of some unreserved forests north of the Wainganga river in the Seoni district. This, however, is neither new nor unexpected. It was intended at the time of settlement that the area of the unreserved forests should be available for the extension of cultivation, and, consequently, fields and villages have been established within their limits. Then, as regards the protection and improvement of the existing growing stock, this cannot be expected, nor is it seriously contemplated under the present system of management. Nor would, in these districts at least, a system of periodical closing of blocks be feasible. I am aware that in the Damoh district much is being done to improve the unreserved forests, and that a large area has even been successfully protected from fire. Such efforts are most praiseworthy, but, as a rule, the only measure that seems to promise security for the future is the formation of new reserves. For the Seoni, Jabalpur and Damoh districts one-inch scale maps exist, which shew the boundaries of villages and waste-land blocks. I am of opinion that the work of selecting additional reserves would be much facilitated if those areas, which still are *bonâ fide* unreserved forest, were, as far as practicable, indicated by a green tint on these one-inch scale maps. This work ought to be done on the spot, and would, in my opinion, be a most useful occupation for young forest officers who have but recently come to this country. The boundaries of the remaining Government forest lands cannot of course be laid down with complete accuracy on these maps, but the maps would be a great help in determining the boundaries of the new proposed reserves. A brief descriptive account of each block visited should accompany the map. For Mandla and Balaghát, maps on the same scale are now under preparation by the Topographical Survey Department. Colonel Depree, with whom I had the privilege of discussing these matters at Mandla, kindly shewed me some of these maps prepared under his direction, and explained that, though the complete village boundaries were not shewn, all tri-junction pillars were entered, and with the help of these it will probably be possible to shew approximately on copies of these maps the boundaries of the forests outside the reserves which yet remain at the disposal of Government.

In these districts it will be necessary to indicate on the maps the position of those settlements of Gonds and Baigas who practise Dhya and Bhewa cultivation in the unreserved forests.

Steps taken for the selection of new reserves.

4. It is believed that in the vicinity of the Nerbudda river, both on the north side in the Mandla and on the south side in the Seoni and Mandla districts, some good blocks of unreserved forest are available, the produce of which can be brought to the Nerbudda river below the principal rapids or barrier. These

blocks are now being examined, and it seems to me important for the future interests of the country, that, if possible, they be demarcated as reserves. I also understand that enquiries have been set on foot regarding forest lands available in the Damoh district, and it is to be hoped that blocks will be obtained in that district more promising than Singrampur. I would also suggest that the unreserved forests on both sides of the Jabalpur and Allahabad railway line be examined in order to ascertain whether areas for the supply of bamboos and small building wood to Allahabad and for the supply of forest produce to the neighbourhood cannot be obtained.

The main points to be kept in view, whenever it may be decided to demarcate fresh reserves in any portion of the Central Provinces, are, that the soil should be good, and that they should be as conveniently situated as possible for the export of their produce. This rule must, of course, be applied with common sense, for there are obvious exceptions to it. Forests on poor soil may yet be valuable and worth maintaining and improving as forest reserves if situated near a line of railway or offering facilities for the export of their produce.

All reserves cannot be subjected to the same treatment.

5. A considerable extension of the reserved area may thus be expected in the districts named, and a similar extension will probably become necessary in other districts also. But it will not be necessary to close the whole of the reserved area at once, or to subject it to the same degree of intensive management. In the Moharli reserve of the Chanda district a commencement in this respect has, I understand, already been made, two blocks only having been closed, the remainder of the reserve being left open for grazing and the export of produce against payment.

In the same manner, if the area of reserves in the districts named is largely increased, it will be possible to open a considerable area of the reserves to pasture and to permit the removal of grass, bamboos, and mowah against payment of certain rates. These arrangements must be most carefully made, so as to guard against the growth therefrom of prescriptive rights. There will thus be reserves subject to two different systems of treatment and management.

In all reserves, however, boundaries must be strictly protected against encroachment, and the land must be permanently maintained as forest, with the exception of certain small areas which it may be found expedient for special purposes to bring under the plough. Thus, the working and management of the forests may render necessary the location, within their limits, of a certain amount of population, for the supply of whose wants fields will be required. Barring such exceptions, the whole of all these estates must be permanently maintained for the production of timber, bamboos, fuel, wood for iron-smelting, fruits, lac, grass, and other forest produce. Consequently all reserves must be rigidly protected against unauthorised cutting, pasture, or the removal of any forest produce.

Different treatment of different reserves.

6. Up to this point all reserves will be treated alike, but, as regards the system of utilising their produce and the measures adopted for their improvement, there will necessarily be great differences in their management and method of treatment. A limited number of blocks will be subjected to intensive management; they will be protected from fire, endeavours will be made to increase the production of lac, and they will be improved by sowing and planting, cutting of creepers, and other operations. In the detailed remarks which will be submitted regarding each reserve visited, it will be seen that some of the reserves which have hitherto been most successfully protected from fire have such poor soil and are so badly stocked that we have seriously considered the expediency of continuing fire protection in these forests. Nevertheless, I am strongly of opinion that for the present fire conservancy must not be discontinued in any forest in which it has for some time been successfully maintained. In the districts, therefore, to which the present report relates, fire protection should in my opinion continue to be maintained in all forests where it has been successfully commenced, *viz.*, in the two selected blocks of the Satpura reserve, in Pandratola, in the Banjar forest, in Jagmandal, Chohari-ghogarh and Barela, as well as in Singrampur and Bijerághogarh.

Extension of fire conservancy.

7. But as regards the extension of these operations to the other existing reserves, and to any additional areas which may be demarcated, the leading principle which must be strictly followed is to attempt fire conservancy in those

areas only which have good soil and give promise of good production of timber and other produce, and which offer facilities for the export and utilisation of their produce; and for this reason I am not inclined at present to recommend the further extension of fire protection in those portions of the existing reserves in which it has not yet been commenced.

Intensive management must be concentrated upon limited areas.

8. Two main reasons seem to me to demand the concentration of intensive management upon limited areas. One is that it will enable us considerably to increase the area of permanent reserves without making it difficult for the surrounding population to provide themselves with the forest produce they require. Second, that the staff of controlling officers and of experienced and trustworthy native, executive, and protective officers, is not yet strong enough to warrant the extension of intensive management over the entire area of our reserves.

The formation of two classes of reserves not advocated.

9. These remarks must, however, not be misunderstood. I do not advocate the establishment of two classes of reserves, special and ordinary, for it is impossible to say beforehand which blocks will be best suited for intensive management, and under all circumstances the intention is, and must be, that eventually the whole area of the reserves shall be subjected to intensive management. There will also be a certain gradation in this respect. As the local native officers in any particular reserve or block of any reserve become more experienced and trustworthy, much progress may be made in the treatment of that reserve; and works of improvement, such as propagation of lac, creeper-cutting, and even fire protection and sowing and planting, may be entrusted to them.

This is the direction in which progress must be made; and in whatever way the working and improvement of any reserve can be extended, it may be done, provided the local establishment of rangers and foresters is competent and sufficiently trustworthy to do it. These remarks will have made it plain that a division of the reserves into two classes, special and ordinary reserves, is, in the Central Provinces at least, entirely out of the question.

Distribution of local forest establishments.

10. It may here not be out of place to say a few words regarding the duties and distribution of the local forest establishments, and in this case I wish to refer to the reserves in the whole province. The new scale of establishments for the reserves provides for 11 forest rangers on rates of pay between Rs. 50 and Rs. 150; 36 foresters on rates between Rs. 15 and Rs. 40; and 135 forest guards on rates between Rs. 7 and Rs. 12. My experience in forest administration inclines me to say that, as a rule, it is desirable to maintain a large number of controlling charges or divisions of limited size directly under the Conservator, and a large number of small executive charges or forest ranges directly under each divisional officer. This undoubtedly, as a rule, is the correct principle; and, as forest administration advances, it will probably more and more be acted upon, but in practice its application must often be modified. Thus, in the Satpura reserve it may be best for the present to maintain two or three large ranges and to sub-divide these, placing the sub-divisions in charge of foresters, who will thus form an intermediate class between the executive and protective officers. A similar arrangement may be necessary for the large reserves of the western division,—Bowergarh, Kalibhit, Rajaborari, Kamapur, and Sowligarh. Each of these reserves will probably be placed in charge of a ranger and be divided into a number of sub-divisions, which will be in charge of foresters with a number of guards. This arrangement is possible as long as simple protection is the most important part of the working of these reserves. But where the reserves are of less extent, such as in Bijerághogarh, Barela, Singrampur, Bori, and Jagmandal, it will be found of the greatest advantage to maintain the present arrangement, under which one ranger or forester is in complete executive charge of each reserve or group of reserves, he being directly subordinate to the divisional or sub-divisional officer, and the forests guards being directly subordinate to him. Nothing is more calculated to create or stimulate the sense of responsibility in the case of local forest subordinates, than a charge of limited extent and direct responsibility to the divisional or sub-divisional officer. As a rule, it will be found that those rangers or foresters, whose charges are not larger than they can efficiently manage, and who are subordinate to a divisional or sub-divisional officer, the extent of whose division enables him at any time to visit each range unawares and without

much preparation,—it will be found, I say, that among rangers and foresters thus located the greatest progress in the good management of their forests will ordinarily be made.

Collection of woods and other forest produce at the Conservator's office. Forest library and reading-room.

11. I wish to take this opportunity to draw the attention of Government to the advantage which would result from establishing at the head-quarters of the Conservator a museum of woods, bamboos, and other forest produce. Such a collection would only require one large room and a carpenter on say Rs. 15 a month to look after it and to prepare the specimens as they come in. The bulk of this collection would consist of specimens in book form arranged on shelves, but there must be larger specimens besides of the more important kinds to illustrate the mode of growth of different kinds, under different circumstances, and in different forest districts. Besides woods and bamboos, there should be specimens of lac and of other forest produce.

It is obvious that this collection, to be of practical use to forest officers and to others interested in the trade in timber and ornamental woods, must be special, and cannot be combined with any general museum. It should be in the Conservator's office, and in the same building there should be a room for the forest maps, reports of the province, and a small library of standard works, which, besides professional and scientific works, should contain a complete collection of settlement reports and published maps of the province. The library should be so arranged as to serve as a reading-room for the use of forest officers passing through, or staying at the head-quarters of the Conservator. Such an institution in every province would meet a want which has long been felt by forest officers, and would at a small expense facilitate the spread of useful information and stimulate the research into professional questions of great practical importance. And what is further of great importance, it would enable the Conservator to furnish on the spot a great deal of practical information to persons from Europe, who will doubtless in course of time visit India, in connection with the export of ornamental woods, fibres, gums, and other useful forest produce.

Progress of forest administration in the Central Provinces.

12. I cannot close these introductory remarks without expressing the pleasure which I have experienced in seeing the great and uniform progress made in the forest administration of this part of the Central Provinces since I first visited it in 1863. Since that time the permanent forest reserves have been selected and demarcated, and though the selection of the areas that have been demarcated may, in some instances, be open to question, these estates will be of very great value after their productive powers shall have been improved.

These estates are now in safe keeping, their boundaries are perfectly defined in a permanent manner, and they can neither be alienated nor readily encroached upon. At the same time all is being done that circumstances permit to effect the gradual improvement of their productive powers, and to make that produce which may be removed with due regard to their improvement, available for export trade and the requirements of the population in the vicinity. Great success has been achieved in the matter of fire protection. From the detailed remarks in the following paragraphs it will be seen that a large portion of the reserves visited this year has been protected for a considerable time, and that this has been effected at a very small outlay, which is being diminished steadily every year. The beneficial effect of fire conservancy is as yet more marked in the case of the existing crop, which everywhere shews a vigorous growth and a most satisfactory increase. But large additions are made every year to the existing crop in the shape of abundant self-sown seedlings, and these will doubtless in course of time completely re-stock the impoverished and exhausted forests which are entrusted to the care of the Forest Department in the Central Provinces.

To a casual observer the benefit which has resulted from fire protection may appear small, because the young seedlings have not yet had time to overtop the grass under which they are mostly concealed, but a commencement of a most important change in the condition of these forests has been made, and n a few years the result will be patent to the most superficial observer.

The small experimental plantations of former years which were visited by me are in a satisfactory state, and an excellent beginning has been made at Korai in the establishment of plantations on a larger scale on a cheap yet thoroughly efficient system.

Good results have been attained in the propagation of lac, and there is every prospect that this valuable produce will soon form an important item of revenue from these reserves.

The native officers in charge of the smaller reserves, particularly of Jagmandal, Barela, Singrampur and Bijerághogarh, are well acquainted with the forests entrusted to them. They fully realise the responsibility of their charges, and they are in a good way of becoming efficient executive officers. It was a great pleasure to witness the great progress which has been made in this respect.

I deem it a privilege to be able to say that Captain Doveton's forest administration in the Central Provinces, is, as far as I had opportunities of judging, efficient and is progressing steadily in the right direction. At the same time his administration is conducted with the strictest regard to economy. This is a matter of the greatest importance in the Central Provinces, for the present reserves are poorly stocked, and the demand for the produce which they *are able* to furnish at present is limited. In one respect indeed, with regard to the local forest establishment, economy has been carried somewhat too far, but this is not Captain Doveton's fault, for he has represented repeatedly the necessity of an increase of these establishments, and the increase which has now been sanctioned will shortly repay itself by an increased revenue, quite apart from the progress that will be made in the improvement of the forests.

All this progress is of a lasting and permanent kind. It will greatly contribute to the future welfare of the country, and it is satisfactory that this progress has been made without inflicting any considerable hardship upon the population in the vicinity of the forests. The best proof of this is the small number of offences committed in these reserves. In one case, in the Bijerághogarh reserve cases of cattle trespass were common soon after the reserve was closed, and the planting of a hedge was commenced in order to facilitate protection. Within a few years this has been found to be quite unnecessary, the people have now become accustomed to the new order of things, and cases of cattle trespass very rarely occur. This is not surprising, for in none of the five districts to which the present report relates does the aggregate area of the reserves attain 10 per cent. of the total area of the district. I request attention to the figures entered above in paragraph 2. As already explained, there is room for a considerable extension of the reserves, and this may be effected under the same good system of management as that hitherto pursued in the Central Provinces, by gradually closing the new reserves, without any appreciable hardship to the people.

CHAPTER I.

SATPURA RESERVE.

Area.

13. The area of the reserve is 468 square miles, and it is situated in the four districts, Seoni, Chindwarra, Nagpur, and Balaghát. Its length is about 74 miles from the Kankan river to Ranikothar in the Wainganga valley, and its width varies from 4 to 10 miles. It is situated on the edge and slope of the Ghâts, and below Ghát. The principal rocks are gneiss and other crystalline rocks. Trap occurs near the edge of the Ghâts, and is often capped with laterite.

Boundary line.

14. Along the boundary a line, on an average 60 feet wide, was cleared when the reserve was formed, and was kept clear for a couple of years; but it has not been cleared for the last four years, except in that portion which has been preserved from fire. It is necessary that the boundary line should be kept clear throughout. This can be done at a small annual expense now, while, if neglected for some time, it becomes a serious charge. Unless the boundary lines are kept clear, encroachment cannot be prevented; and the want of definition of the boundaries is hard upon the surrounding villages. At all prominent angles there are masonry pillars, sometimes cylindrical, others of a prismatic shape. These last-named are placed at points from which interior survey

lines branched off from the outer boundary. The boundary pillars, however, have no current numbers.

15. The following maps are available :—on the scale of 4 inches to a mile, manuscript maps, prepared by the revenue survey, of that portion situated east of the Great Northern Road. These are copies of the revenue survey maps deposited in the offices of the Deputy Commissioners of Seoni and Balaghát. On these maps the course of streams and ravines is shewn in great detail, and is believed to be fairly accurate, but the names of the streams are either not entered at all, or with few exceptions are not in accordance with the local names known by the people. Paths and roads are entered, but the main roads which are actually in use are not distinguished. Inside the reserve we found a number of pillars on the old boundary of the reserve which are not entered in the map, nor is the site of the village Sakáta entered, nor are the boundary pillars shewn. Maps.

These maps in their present state are very incomplete, and not of much practical use for forest purposes. They can, however, readily be made useful by entering such important points as are now wanting, and by completing them in other respects. Before arrangements are made to enter the boundary pillars on the map, current numbers should be painted on them, and these numbers should be shewn on the map. It will not be necessary here to have these numbers all in one series. At the same time the correct names of all streams which have a local name should be entered, and equally so the names of hills, rocks, and other places. Cart roads and frequented footpaths should be clearly distinguished, and all villages inside the reserve and their cultivated area should be entered. This operation will require a certain amount of surveying, which must be done accurately, and it should be considered whether it can be done by the local establishment or whether it will require the assistance of the forest survey staff. Maps on the same scale made by the revenue survey are doubtless available for the other portions of the reserve, and they should be completed in the same manner. The one-inch scale maps of the revenue survey are lithographed and will probably be most useful as general maps for daily use. Arrangements should be made to have these maps joined together in two sheets for ready reference. These one-inch maps should be completed by entering further detail in manuscript as far as possible. For the present these one-inch maps will probably suffice to shew all detail of a temporary nature, such as the blocks open for bamboo-cutting, the blocks preserved from fire, and the like. For these purposes a large number of these one-inch maps should be prepared, each in 2 sheets, for convenient use. An early opportunity should be taken to enter the geological formations on a copy of the one-inch map.

16. The Korai block has been preserved from fire for the last 3 years, the first hot season having been that of 1872. Protection is effected by clearing and burning completely an outer line about 60 feet broad; the first burning this season took place about the middle of January. It was not found necessary to cut anything except high grass in a few places. Originally when the lines were cleared the teak trees were cut also, but for the last 4 or 5 years shoots have been allowed to grow up. These shoots should be cut, and teak, like other trees, should be exterminated on the boundary line. The protected block extends from the Great Northern Road eastward to the block line between Chanderpur and Aturwáni. It contains 31,000 acres. The eastern boundary is a line which is not used as a road, and which is difficult of access. It would doubtless be preferable to extend the protected area to the cart road which leads from Bisapur through Sakáta to Sareka. This is a well-frequented road which would make a very convenient boundary of the block. In that case it would be necessary to exclude the northern projection marked on the maps as waste land block X^8 to the north of a cart road from Sareka to Aturwáni. This would add about 10,000 acres to the protected block, but this addition would, in my opinion, facilitate its protection. Perhaps a contract may be made with the inhabitants of Sakáta to undertake the protection of a portion of this block. Korai block. Improvement.

17. The protected block has hitherto not been worked at all, with the following exceptions :— Working of Korai block.

Four villages—*viz.*, Pindreye and Goruekpur below Ghát, Sakadeye and Khapa Durassee above Ghát—are at present permitted to graze their cattle

against payment in two defined chucks near the edge of the reserve; but this privilege is only allowed from the 1st of July to the 31st of January, and may, I understand, be discontinued whenever considered necessary.

Rukar village is enclosed within the protected block, and has given no difficulty. The inhabitants are permitted to graze a limited number of cattle in the reserve and to provide themselves with wood and bamboos for their requirements.

Permits have been given for the cutting of grass, a small quantity of bamboo has been cut, and mohwa, gums and seeds collected departmentally.

There is no objection to this being continued; on the contrary it is desirable that grass and bamboos should be utilised in the protected block as much as possible, provided that this does not interfere with fire protection. Dry wood, in case there should be a demand for it, might be collected, but green wood should not generally be cut in the protected block, as it is of the utmost importance that the cover overhead should be as much increased as possible. Some teak poles, which are not likely to improve if left standing, may, however, in a few localities, be coppiced with advantage.

Secondary lines in Korai block.

18. The protection of this extensive block in my opinion is hardly safe without secondary lines, which at present do not exist. These lines should be so selected as to be used by traffic between villages above and below Ghát, and to be made eventually available as lines of export of forest produce from the reserve. One of these lines would be the path which is at present kept open from Sakadeye to Goruckpur, and another which cuts across an angle of the reserve from Sakadeye to Rukar. These lines should be open for traffic, and a belt should be cut or burned on either side in the usual manner. The selection of these secondary lines will require most careful examination of the ground, and must be carried out gradually. It may, on the other hand, be urged that under existing circumstances the safety of the forest to a great extent depends on the exclusion from it of human beings.

Result and suggestions for the future.

19. The result of protection has been marked in the healthy appearance of the poles of teak and other trees, and in the large number of seedlings that have made their appearance on the ground. In places "salai" and other useless trees have benefited most by the protection, but elsewhere seedlings of teak, blackwood, bija and saj are numerous, and much has been done to improve their growth by clearing the grass from around them.

Creepers of the 3 species, Butea, Bauhinia and Derris, are very numerous, and it is for consideration whether they could not gradually be exterminated. They are especially numerous in the better portions of teak coppice, and many a fine pole will hopelessly be injured unless speedy measures are taken for the destruction of these creepers.

The fire protection of a second block on the east side of the Pench river has been taken in hand this year.

Plantations.

20. In 1868 or 1869 a small plantation of teak was established at Sakáta, the plants being raised in nursery beds, and transplanted. The trees left standing on the nursery are very unequal in size; the dominant trees are about 20 to 25 feet high, with an average girth of 13·6″ at 12 inches from the ground and of 10·7″ at breast height. The plantation formed in the same year from the nursery covers rather more than 3 acres, and in the best portions the trees are 18 to 24 feet high, with an average girth of 10·7″ at 12 inches from the ground, and of 8·2″ at breast height.

The trees were planted and still stand at intervals of 5 to 6 feet. The cover is nearly complete, and little or no grass grows underneath. Many trees have made side shoots from the roots, and some have double stems. All trees are branched low down. Fire has evidently entered the plantation at one time or another. At a later date, probably about 1870, a small plantation was made in the vicinity of the nursery.

In 1867 about one acre was planted with teak at Morkhera in Sonawáni. The plants were raised in a nursery at Silajheri, not far off. The plantation occupies a high open ridge, well drained and sloping down on all sides. The site was formerly used as a cattle-pen, and the ground was therefore highly manured when the young plants were put out. The height of the trees is between 30 and 40 feet, and their average girth at 1 foot from the ground is 15″, and at breast height 12·4″. The cover is complete, and no grass or shrubs exist on the

ground beneath. The stems are regular, have cleared themselves well, and are not branched down to the ground. Fully one-half have been suppressed. The trees were planted at 6 feet by 6 feet apart. As experimental plots, these plantations are very interesting, but it is not desirable here or anywhere to extend the system of pure teak plantations.

Korai plantations.

21. In the vicinity of Korai are a number of plantations made at a later date on a different principle. Here the seed was sown in pits 12 inches deep, the pits being generally 4 feet by 5 feet apart. The plan has been to excavate the pits immediately after the rains, and to re-fill them after the first showers of the monsoon, after which the seed was sown. I examined the plantations of 1873 and 1874 made on this system. The seedlings of teak and sheeshum (blackwood) were promising, the latter having succeeded best in the plantation of 1874. This was partly owing to a wet soil, which did not suit teak. The sheeshum plants are about 12 inches high, and, apparently, do not require any further clearing. On this site, as well as on the site prepared for next rains, the whole forest has been cut down. I am, however, informed that this was not intended and forms no part of the system, but was the result of an oversight. All forest growth should certainly be left standing, when badly-stocked blanks are planted up. The trees left standing may not yield valuable timber, but they will afford some shelter to the young plants. All sowings should be made in continuous lines, which, according to circumstances, should be from 10 to 20 feet apart, and in the lines the plants should be close together. The preparation of the lines may in some cases be effected by ploughing; in others a continuous trench may be dug, interrupted whenever trees and shrubs are in the way; or a line of pits at distances of 2 or 3 feet apart may be employed instead. The present plan of digging the pits at the end of the rains and filling them at the commencement of the ensuing monsoon is excellent, and should be continued. But whatever be the method employed, the lines should be at least 10 feet apart. The expenditure will thus be lessened, while shoots and seedlings will spring up in the intermediate space, and thus render the mixture more complete. In future sowings, sheeshum should be largely sown, and I am inclined to suggest that the seed of sheeshum and teak should be brought from Ahiri; Burma teak seed might also be tried. A plantation on another system was examined near the village of Rukar, where lines had been ploughed and dug up in June 1874, and sown with teak, bija and saj. The plants have come up and look promising. They should be covered with branches, so as to protect them from the sun in the hot weather. The expenditure incurred on these different plantations has necessarily varied exceedingly. Thus Sakáta has cost altogether, since its first establishment, about Rs. 760 per acre. Sonawáni in the same way has cost about Rs. 520 per acre. The teak sowing of 1873, on the Jaman nala near Korai, has cost up to date about Rs. 15 per acre, the sowing of 1874 about Rs. 10, and the sowing of 1875 is estimated to cost Rs. 5 per acre up to the end of 1876. The first figure, Rs. 15 per acre, may now be taken as a limit which will probably not in future be exceeded in making these plantations.

Cultivation of lac.

22. Some very successful experiments in the propagation of lac have been made near Korai. I examined the plantation formed in November 1874, near the Jaman nala. The seed lac was put on palás trees and bér bushes in November 1874. Nearly all the palás trees are now full of lac, so much so that the top branches are beginning to dry, and I should not be surprised to learn that some of the trees have been killed by the insect. However, when the operation is in regular swing, the branches on which lac is formed are pollarded and shoot out afresh. The lac that had been formed on the bér bushes was of an inferior quality. This is ascribed to the fact that the lac of the palás tree had been used for impregnating the bér. It is evident that there is no difficulty in propagating lac on a large scale. Nor is the procedure new; propagation of lac on palás and kusam trees is practised in many parts of the Central Provinces, particularly in the central and eastern districts. Before, however, extending the experiment on a large scale, it should be considered whether the first step should not be to stock a large area with palás and kusam and to raise a complete crop of these trees before seed lac is put upon them. An important question is, what character the future lac-producing forests will have, whether they will form a sort of underwood under timber forest of teak and other valuable trees, or whether they will form forests by themselves.

At the same time, however, the natural-grown trees that are found along nalas and ravines, such as kusam and the various figs, may be utilised and made to produce a large quantity of lac. There can be no comparison between the quantity of lac that would be formed on large kusam trees, and that produced in the same time on the ill-grown and small palás trees that occur in the lower parts of the reserve. At any rate, the naturally-grown trees should be utilised while the future lac plantation is growing up. By the time this is ready a large natural crop of lac will be available both for the market as well as for further propagation.

Yield and revenue.

23. The revenue of the reserve during the last four years has been as follows :—

				Rs.
1871-72	...	...	...	6,612
1872-73	...	...	...	7,596
1873-74	...	...	...	11,639
1874-75	...	...	...	14,584

and up to the end of December 1875-76 it amounted to Rs. 11,190.

The principal items of revenue have been from bamboos, grazing, small timber, grass, mohwa and other produce. A small quantity of bamboos, not exceeding half a lakh a year, were taken out by departmental agency and sent down to Kampti and Nagpur for sale, and have generally realised a large profit. Larger quantities have been removed on permit, the total quantity thus taken out by purchasers having exceeded two lakhs during 1874-75; of this amount nearly a lakh and a half came from the Sonawáni division alone. These permits are granted by jemadars and duffadars at rates varying from Rs. 7 to Rs. 18 per 1,000, according to the quality of the produce and the accessibility of the tracts from which it is taken. Certain villages are allowed to bring out fixed quantities of bamboos annually for their own use at special rates.

Export of bamboos by departmental agency.

24. As regards the export and sale of bamboos by departmental agency, it should be considered whether the vast growing stock of excellent bamboos in the eastern part of the reserve, commencing from near Sakáta, west of the Katangi road, and extending to the Sarati river, could not be better utilised for the production of revenue. Probably the construction of the Chatisgarh railway will open up a field for the export of the yield of this splendid bamboo forest to Wardah and Berar, while with an increased demand it will be possible to open up more direct communication with Kampti and Nagpur. Before, however, any extensive operations are commenced, it will be necessary to divide the bamboo-producing tracts into blocks, with the view of closing a block completely after it has been sufficiently worked. The length of time during which each block should remain closed must be determined by experience. The boundaries of these blocks may most conveniently be laid along ridges. The export roads for bamboos generally follow ridges in this forest, and it should be considered whether the division lines of the blocks should be laid along main streams; no expense need be incurred in demarcating their boundaries on the ground, but they must be entered on the 4-inch map and each block must have a local name.

Utilisation of the Sonawani bamboo for the manufacture of paper.

25. The bamboo-producing tract here referred to is so extensive that it should be considered whether it may not yield material for the manufacture of paper stock. The size of the young shoots of last rains was most remarkable, being on an average 40 feet long, and 7·5 inches in girth, and their number in each clump considerable. This is probably the result of long immunity from cutting. A factory might be established near the edge of the plateau, any amount of labour for cutting and collecting the young shoots might be had at 2 or 3 annas a day, and one great recommendation in favour of selecting this locality would be its excellent and healthy climate. The produce would be exported to Nagpur and thence by rail to Bombay.

The first step.

The first step towards testing the practicability of utilising the bamboos of the Sonawáni forest for paper manufacture will be to prepare in a rough manner a small quantity, say 100 tons, of fibre, and send it to England to be tested. It would be necessary for this purpose to establish simple machinery to crush between rollers the fresh bamboo shoots. It would probably be an advantage if the crushed stems before being dried could be steeped in a stream of running water so as to wash out as much as possible all sugar, gum, and soluble albu-

minous substances. The crushed and washed fibre would then be dried in the sun, and would be less likely to deteriorate by fermentation than if unwashed. It would, however, be well before deciding on this experiment, to make a rough estimate of what the cost of it would be. The shoots of the bamboo here are said generally to appear in August, and it will probably be time enough to cut them in September. The cutting and a great part of the carriage will have to be done by men, but it is believed that 1,000 bamboos could be delivered at the crushing mills for Rs. 10, and that this quantity would yield at least a ton of crushed and dried fibre. Allowing, then, for cutting and carriage from the forest to the rollers, Rs. 1,000, and the same sum for sheds and the erection of the rolling apparatus, it remains to be considered how much the carriage of the dried fibre would cost. It would be carted in the cold season *viâ* Korai to Nagpur, a distance of about 90 miles, which could be accomplished at the rate of about Rs. 10 per ton. The railway and freight home would amount to about Rs. 50 per ton, thus making the total cost of collection, preparation and carriage to England about Rs. 7,000. It will, however, be necessary in order to ensure its success to place this experiment and all the arrangements for it in charge of a superior officer, whose pay and travelling allowances for a period of 9 months from April to December would amount to say Rs. 5,000. This would raise the cost of the undertaking to Rs. 12,000, and the quantity of material mentioned, 100 tons, when delivered to the manufacturer in England would have cost upwards of £1,200. The question is whether under the circumstances it is desirable to make the experiment, but if it is to be made during next rains, orders must be issued immediately, as otherwise it will not be possible to make the needful preparations. There are many other forests in the Central Provinces where the needful quantity of bamboo could be obtained. Thus, it would be very desirable to utilise the bamboos produced in the Jagmandal reserve, or in the Bori forest. Another place where the experiment might be made is Ahiri in the Chanda district; the stuff might be sent down to Coconada by water, and shipped from there, and the carriage to England from that forest would perhaps be cheaper. These matters should all be duly weighed, but, taking all circumstances into consideration, it seems certain that in the Central Provinces the Sonawáni forest is the best locality for the first experiment. This experiment, if continued for a series of years, will give an excellent opportunity for determining certain questions connected with the growth of bamboos. If from a vigorous bamboo clump all young shoots are cut out, it is probable that they will be reproduced the following year, and perhaps for a number of years. But it must be ascertained by actual experiment during how many successive seasons the cutting-out of all young shoots may be continued without putting a stop to the further supply.

The experiment should be made on a limited and well-defined area of a well-stocked bamboo forest, so as to obtain thereby reliable data regarding the permanent yield per acre of fresh bamboo shoots.

The second step.

Should it be found practicable to produce paper stock from this forest at a sufficiently low cost, then the second step will be, carefully to examine the bamboo tracts and to enter them upon a copy of the 4-inch map mentioned above. This will be a good test of the accuracy of the topographical details of this map. Should it not prove sufficiently accurate, and should a paper stock factory actually be established here, then a fresh survey will become necessary: for without an accurate map of the bamboo-producing tracts it would not be right to take further steps in this matter. Without an accurate and detailed map, it will not be possible either to determine the quantity of growing stock and annual yield of young shoots, or to regulate the working in a systematic manner, or to establish a system of roads for collecting the material from the different parts of the forest.

Grazing.

26. Grazing is now permitted on payment of the following rates:—Rs. 25 per 100 head of buffaloes, Rs. 18 per 100 head of other horned cattle, and Rs. 4 per 100 head of sheep and goats per annum throughout that part of the reserve which is not protected from fire. The people avail themselves of this permission during the year, except the three hot-weather months, when they graze on the high lands of Mandla and Balaghát. There seems no objection to continue this, except in those parts which are protected from fire. The grazing permits are given in June and July by the jemadars and duffadars who are responsible for the proceeds, as well as for the correct entry of the number

of cattle permitted to graze. The number of cattle returned as grazing in the reserve during 1874-75 was about 41,000, of which nearly three-fourths were in the Pench division. The cutting of grass is let out on permit at certain rates per cart load, head load or 1,000 pullas. These permits also are granted by jemadars and duffadars. Grass is more valuable in the south-west portion of the reserve, where, consequently, a higher rate is charged than elsewhere. Grass is mostly exported from the middle of December to the end of January.

Dry and green wood.

27. Wood is exported as firewood, principally from below the Ghâts, partly for the use of the villages in the vicinity, partly for export to Nagpur. The rates vary, but are on an average two annas per cart load. The permits are granted by jemadars and duffadars; it is desirable to encourage the export of dry wood for this purpose as much as possible. It is, however, doubtful how far the local subordinates should be permitted to sell any dry standing timber, which here and there is found in these forests. In the Sonawâni block we came upon the remains of what had been a very large and apparently most valuable bija sál tree, sold by the jemadar without the knowledge of the divisional officer. This practice might give rise to abuse. Green timber is not sold at all from the reserve except in special cases and on the order of the divisional officer. The only exception is in the case of the villages adjoining the reserve, which are supplied with a fixed quantity of building wood annually for their own requirements. For sale on a large scale no timber is at present cut, and this system should be continued without alteration. It is of the utmost importance that the cover overhead in all parts of the reserve should be completed as rapidly as possible, and this can only be effected by allowing the growing stock to grow up without interference. I would not even recommend the thinning-out on a large scale of salai, gooloo, and other worthless trees. They generally occupy dry rocky places, where not much else will grow, and they serve at least somewhat to keep down the growth of grass, and it is not possible to say to what use their gums may be turned at some future time.

Teak.

28. A few words should now be said regarding the distribution of the more valuable trees in the reserve. Teak is only found in considerable quantities in the Korai block between the Great Northern Road and Sakáta, west of Dongarthal, and nearly all along in the forest at the upper edge of the Ghâts. Mature trees there are none, but in places considerable masses of promising poles; and it should be considered what can be done to increase the proportion and to improve the growth of teak. Much has been done by way of clearing natural seedlings in the forest of grass, and this should be continued wherever it can be done in defined belts, but not promiscuously over large spaces; otherwise control cannot be effectually carried out. There can be no doubt that creepers should be cleared away from every teak tree; and much good can be done by cutting down or girdling other trees which overshadow teak and interfere with its growth. It is for consideration whether in some localities irregularly-formed teak coppice should be cut down to the ground in order to produce a crop of straight poles. Regarding the increase of teak by plantations, the needful has been said in paragraph 21.

Blackwood and bija sal.

29. Blackwood and bija sál are found scattered throughout the reserve, the latter occurring of considerable size. In the Sonawâni block they commonly form standards among the bamboos, together with garari, dhobein, saj, tendu, lendia, and other trees of the deciduous forest.

These two species (blackwood and bija sál) should be cultivated wherever plantations are established. Saj is plentiful near the Pench river and throughout the Korai block.

Existing staff.

30. The reserve is at present divided into three sub-divisions:—(1*st*), *Sonawâni* with 1 jemadar on Rs. 35 and 2 duffadars on Rs. 12 each; (2*nd*), *Korai* with 1 jemadar on Rs 25, and 2 duffadars on Rs. 15 and Rs. 12 respectively; (3*rd*), *Pench* with 1 jemadar on Rs. 25, and 3 duffadars on Rs. 15, 12, and 10. Both the jemadars and duffadars have authority to grant permits for the same forest tract, which leads to confusion and is objectionable. Instead of this plan, I am inclined to suggest the establishment of a number of ranges, each in charge of a forester, whose pay should range from Rs. 15 to Rs. 40 or higher, according to the limits adopted for the scale sanctioned for these provinces. Each forester would have the entire responsibility for and management of his range, and would, as at present, be assisted by watchers. He would

be directly responsible to the divisional officer; the only exception being the protected Korai block, where 2 foresters would be under one ranger, the latter having entire control over the block. Each of the two foresters should be specially responsible, the one for the upper, the other for the lower part of the reserved block. If this plan is adopted, the ranges of this reserve might be constituted as follows, subject to further enquiry:—The fire-protected block from the Great Northern Road to the cart road between Sakáta and Sareka should be in charge of one ranger, with 2 foresters under him. The Sonawáni block, which would comprise the remainder of the eastern portion, should be divided into two ranges, one comprising the upper, the other the lower part. This would give 1 ranger and 4 foresters for the part east of the Great Northern Road; and the same number would probably be sufficient for the forests to the west of that road. These suggestions of 6 to 8 separate ranges, all directly under the divisional officer, I offer with some hesitation, as I am aware that for the present it will, for special reasons, probably be found best to continue the present organisation of three great ranges, each divided into several sub-ranges.

CHAPTER II.

PANDRATOLA RESERVE.

General description.

31. The Pandratola reserve is a narrow strip of forest and grass land on the left bank of the Wainganga river, extending over a length of about 10 to 15 miles, and measuring 5,000 to 6,000 acres above and below the village of Chacheri. In the lower part its width is only a few hundred yards, but near the deserted village of Pandratola it is about three miles. The ground is high, undulating, and cut through by ravines, one high ridge or backbone running through the northern or upper part of the Ramna. The boundaries are formed by the river on the west, and by a continuous line of round masonry pillars on the east, which are so placed that one can be seen from the next. Along these pillars a line is kept more or less cleared. The soil is alluvial in places, and on high ground is disintegrated gneiss with kankar. The vegetation consists of two entirely different descriptions of forest. On the high ground it is a low and open forest mainly consisting of achar, lendia, salai, tendu and saj, with much grass and without bamboos. The low ground is mostly occupied by a dense forest of bamboos with standards of teak, and a few large trees of mahwa and saj. With these were found associated the following trees: tinsa, lendia, dhowa, achar, aoura, kusam, khair, dhamin, pádar, ghoti, dhobein. In places the underwood between the teak consisted not of bamboo, but of tendu, saj, lendia and other trees. No accurate map of the reserve is at present available, and it is not possible to venture upon an estimate of the area stocked with teak and that of useless forest. Speaking broadly, however, the latter prevails in the upper portion, which comprises the village of Pandratola, while teak and bamboo constitute the majority of the lower portion.

Fire protection.

32. The forest has been protected from fire during the last three years; this has been done by burning a line all round on the land side, the Wainganga forming a natural protecting boundary on the west. The effect of this protection is very marked in the healthy state of the underwood, and the numerous healthy saplings of teak. The teak trees in this reserve have evidently been drawn up by the surrounding bamboos, and have fairly straight stems about 60 feet high, the girth being, on an average, between 18 inches and 3 feet. The reserve is at present under the Deputy Commissioner of the district, and is consequently in charge of the darogah of the unreserved forests. At the time of my visit, the fire line had not been burnt, though the grass in the reserve was very dry, and the risk of fire very great, the reason alleged by the darogah being that no funds had yet been sanctioned. Under the darogah are four chaprassies, one on Rs. 6, two on Rs. 5 and one on Rs. 4 per mensem, their aggregate cost being Rs. 240 per year, which, with the amount paid for fire conservancy, raises the annual expenditure to Rs. 300.

Yield and revenue.

33. The only produce at present removed from the forest is grass. The whole crop is sold to a thekadar, who this year paid Rs. 254 for it. A large

portion of the Ramna is open forest, some of it on low ground with a splendid crop of grass; and it should be considered whether, in addition to the sale of grass, grazing might not be permitted here until the 1st February, after which date the risk of fire would be too great. This of course should only be done if a corresponding revenue could be obtained thereby. Besides grass, however, a considerable revenue might be made from bamboos. Three kinds of bamboos are found in the reserve: 1*st*, "Kattang" bamboo (*Bambusa arundinacea*) near streams and ravines; this flowered in 1869, the old clumps have disappeared, and in their stead thickets of seedlings have sprung up about 15 feet high. From this bamboo no revenue can be expected for the next 10 years. 2*nd*, a large thornless bamboo, the stems 50 feet long, and 9 to 12 inches in girth, with very thick walls. This bamboo resembles the ordinary Indian bamboo almost in every respect, but is evidently a different species, which has not yet been identified. It is said to have flowered 30 or 40 years ago. This kind is much prized, and a moderate quantity may be cut annually, provided it can be sold at remunerative rates. 3*rd*, the ordinary Indian bamboo (*Dendrocalamus strictus*) of all ages, which is the most common and attains a fair size. In places the bamboo has been overcut, but in an area so limited there will be no difficulty in arranging the cuttings so as not to injure the growing clumps, and there is no object in allowing these bamboos to seed and perish. Some revenue may also be made, provided the necessary supervision is available, by allowing worthless brushwood to be cut for fences and firewood, and in places some mature trees of saj may also be cut, provided revenue can be obtained therefrom. Vigorous-growing poles of saj, tendu and other trees should not, however, be touched, because it is desirable to bring the ground under cover as soon as possible. There are a good many mature mahwa trees in the Ramna; no revenue is realised from their flowers, and considering the large number of mahwa trees round the villages, it is doubtful whether any revenue can be made from this source. No revenue can at present be made from teak, but eventually the teak of this reserve will be most valuable as water-carriage is available, and it should be considered whether in suitable localities teak should not be cultivated.

CHAPTER III.

SÁL FORESTS BETWEEN THE BANJAR AND BORMEYR RIVERS ON THE HIGHLANDS OF MANDLA AND BALAGHÁT DISTRICTS, COMMONLY CALLED THE MAIKAL RANGE.

Demarcation and maps.

34. The sál forests in this tract of country are found in a belt between the Banjar and Bormeyr rivers. They are about 40 miles in length, and from 7 to 10 miles in width. Outside this belt the tree is only found in scattered patches, until you come to the large sál belts of the Soane and Mahanuddee rivers. The sál belt here described is extensive but isolated, larger than, but analogous to, the sál-producing tract of the Deinwah valley and the Paehmarhis. The sál forest is not continuous, but consists of a large number of isolated blocks, of which the following are the most important:—

First.—The Banjar valley forest, comprising an area of about 80 square miles and demarcated in 1874, partly by Mr. Jacob, partly by Captain Losack.

Second.—The Topla or Halun forest, situated on both sides of the Halun river, south of the old village site of Topla, containing about 70 or 80 square miles.

Third.—The Keolakhapa forest, on both sides of the Halun and Kashmíri rivers, between Topla and Keolakhapa village.

Fourth.—The Motinala forest, near the police station of Motinala on the Mandla and Belaspur road, consisting of three blocks on the left bank of the river, of which only one, containing 1,600 acres and called the Motinala block, has been demarcated.

Fifth.—The South Phen block, occupying the low ground between a number of high trap hills and extending from the Belaspur road to about 4 miles east of Mujgaon village.

Sixth.—The North Phen block, lying between the Phen and the Nilhari rivers and the Mujgaon plain.

Seventh.—The Mowai forest, running along the foot of the hills to the north-east of the Nilhari river. This was sold in 1867 to Mr. Michia.

The blocks mentioned under *second* to *sixth* were demarcated in 1873-74 by Mr. Jacob. In the area here described, crystalline rocks, gneiss, mica-schist and quartzose rocks predominate, but in many places, and particularly along its southern edge, these rocks are covered by layers of trap, varying in thickness, and here and there extensive deposits of laterite are found. The tops of many of the hills consist of trap.

Sál, as a rule, is only found on crystalline rocks and laterite, but in one place, in the South Phen reserve, we found a promising forest of sál poles, on trap, which, however, in this place is probably mixed with quartz Speaking broadly, therefore, the sál tree maintains its character as requiring a water-transmitting soil, and it is found equally where that soil is of the nature of a light sandy loam or sand, or consists for the greater part of stones or boulders. Here, as in the Deinwah valley and Pachmarhi sál forests, the sál tree is found on loose water-transmitting soils, but it disappears wherever we enter the heavy clay soil which overlies the trap formation. The same facts may be observed in the sál forests of Oudh and the North-Western Provinces, and the sál forests of the Meikal range furnish another proof of the predilection of the sál tree for a certain class of soil.

The sál forests here mentioned are surrounded either by open grass lands, with scattered villages, or by forest of other trees, generally mixed with bamboos. As a rule, their limits are well defined, although here and there outlying groups of sál trees are found outside the main blocks. In the vicinity of the Banjar river, the country is generally well wooded; further east it is open and bare, and the forest of other kinds which is mixed with the sál forest is of a poor character. Under these circumstances, the demarcation of the sál forests was not a difficult task; and, as a matter of fact, there are only a few points in the boundary of the Banjar Valley forest and in some of the others where, if more time could have been given to the work of demarcation, the boundary might have been laid differently. In 1873 it was decided that maps of these reserves should be prepared by the officers of the Topographical Survey, and to enable them to survey the boundary line, it was necessary to put down the boundary marks at once.

As a matter of fact, all the more important sál forest blocks have, with the exception of the Mowai forest and the blocks near Motinala mentioned above, been included within the reserves. The topographical survey of the Mandla and Balaghát districts is made on the scale of 1 inch to the mile, but the reserves have been specially surveyed on a larger scale, *viz.*, 4 inches to a mile. At the time of our visit, proof copies of the 4-inch maps of the Keolakhapa, Motinala and North Phen forests were available, and we examined them on the ground. These maps are beautifully drawn. They give the serial number of each boundary mark, a complete delineation of the rivers and their feeders, the principal paths and roads through the reserves, and all trigonometrical survey stations inside the reserve, as well as the site of villages outside it. The configuration of the ground is indicated by contour lines, stated to correspond to differences in level, varying from 15 to 30 feet. I am inclined to think that contour lines of 50 feet would in these forests be quite sufficient. Open grassy plains near streams are also separately shewn. These maps will be amply sufficient for all present requirements of the Forest Department.

Boundary lines and boundary marks.

35. Where the boundary lines pass through forest, they have been cut 30 feet wide, and I think that, whether the forest is protected from fire or not, these lines should be kept clear, and for that purpose should be cleared and burnt annually. The maintenance of a cleared boundary line is not only the most efficient safeguard against encroachments, but is imperatively necessary in the interests of the surrounding population. The boundary marks consist

of heaps of stones surrounding a rough post of sál wood about 12 feet high, on which the serial number is painted afresh every year. These boundary marks are erected at all angles and prominent points, and one post can always be seen from the next. For the present, this description of boundary marks will suffice, and their main advantage is that they can be seen a long way off, but I am inclined to think that, as a permanent arrangement, it will be necessary to add or to substitute for them short posts of sound-heart wood of sál, which may in many cases be made out of rejected sleeper pieces, and on one face of which the serial number should be cut in. I would have these posts 3 to 4 feet long, of which 2 feet should be above the ground. They should be flat on one side near the top, and on this side the number should be cut. The other sides need not be squared, but the sap-wood should be cut off all round. Those short posts should be surrounded at the base by a square sunk platform of stone, flush with the ground, and the entire post, as far as it stands above the ground, should be whitewashed once a year after the rains. The number cut in may be painted annually, as at present. This description of boundary marks I consider preferable to masonry pillars, provided the posts are made of sound-heart wood, and they will be found much less expensive.

But, as already stated, this is a matter for future consideration, and at present the tall boundary posts may be maintained; but the greatest care should be used in renewing the serial numbers every year, for, if these once begin to be illegible or doubtful, the value of the maps will be greatly diminished.

Demand for timber, grazing, and forest produce.

36. A large number of cattle come up annually to these high lands from the open country of the Nagpur, Wardha, Chindwarra and Seoni districts to graze during the hot season. The plentiful water-supply in the numerous running streams and brooks for which these hills are remarkable, is probably the great attraction; but besides there is an abundance of short grass on the extensive unwooded rolling ground and bare hills which intervene between the scanty villages and cultivation, and formerly, as long as the sál forests were open, the pasture in the open glades in these forests was doubtless excellent after the old grass was burnt. The Banjar forest, which is now protected from fire, has of course been closed against cattle, and, as fire protection is extended, the other reserves also must be closed, but their aggregate area, which is estimated at 230 square miles, is a small portion only of the total area available for the cattle from other districts. The villages in the immediate vicinity of the reserves are so few and have so little cattle that they are amply supplied by the grazing ground left to them. Unfortunately there is no demand for cut grass, nor is there any demand in the district for bamboos, firewood and timber from the reserves. The only considerable demand is for timber at Jabalpur. It would be idle now to speculate on the question whether the sál timber from these forests can successfully compete at Allahabad with that from Nepal and Oudh, but it is probable that if the railway consent to favourable rates from Jabalpur to Allahabad, the timber from these forests may command a ready sale at that place. At all events, there is at present a certain demand for sál timber at Jabalpur.

Timber operation.

37. Hitherto the only timber brought from these forests has been in the shape of railway sleepers, of which about 30,000 were sold to the Great Indian Peninsula Railway in 1869 and 1870, besides a small number of logs supplied to the Public Works Department about 1866. In 1874 upwards of 500 logs and scantlings, aggregating 8,000 cubic feet, the largest measuring 50 cubic feet, were brought to Jabalpur, of which about 80 have within the last month been sold at rates varying from Re. 1-3 to Re. 1-11 per cubic foot. A second batch of 446 logs were floated to Mandla in July and August last, and are now lying at the Sukri Ghát Depôt, whence they will be floated to Gwarighát in September next. A portion of these logs were squared at Kisli and Indri. They aggregate 12,700 cubic feet, and the largest log measures 97 cubic feet. A similar quantity is being brought out from the forests this year, but the logs are much larger, averaging nearly 45 cubic feet. The whole of this timber was cut from dry and old felled trees and timber, no green trees having been cut since 1874. I examined a large portion of this year's timber at Khana and Kisli; the whole of last year's timber at Sukrighát and that of 1874 at the Gwarighát Depôt. I have thus seen upwards of 1,000 logs, being the outturn of the current and the two preceding years; and the most remark-

able fact regarding them is, that the great majority of the logs are sound throughout, and that only a small percentage (76 logs out of 446 at Sukrighát Depôt) were found to be attacked by the carpenter bee. The soundness of the timber from these forests, as compared with the forests of Oudh and the North-Western Provinces, has often been mentioned in previous reports. It is a fact of very great importance and will always secure for the timber from these forests a great advantage over the produce of the Oudh and Nepal forests, with which it will have to compete in the Allahabad market. Considering the rates which Nepal and Oudh timber command at Allahabad, we may safely assume that logs fit for building purposes will always be saleable at Re. 1 per cubic foot at Jabalpur. The present railway charges for carriage to Allahabad amount to about 4½ annas per cubic foot. The question therefore arises whether timber from these forests can be sent to Jabalpur at such a cost as to leave a margin of profit. The sleeper operations of 1869 and 1870 are no guide in that respect, as they were undertaken at an exceedingly short notice and had to be pushed on so as to effect delivery by a certain date without any regard to economy. The mode of transit of timber from the different reserves is as follows :—

From the Banjar forest it is carted to Tilree, a depôt on the Banjar river, about 21 miles from Mandla. In the forest the principal depôt is at a place called Khana, 14 miles from Tilree, and the carting is done by means of Government buffaloes and Government carts. These carts are simple, but admirably suited for the purpose. Iron axles and wheels, with brass naves and wooden spokes and felloes (light field battery wheels, Madras pattern) purchased from the Ordnance Department, are provided with beds of sál wood on which the logs are laid. All these arrangements are excellent and are conducted in the most economical manner. At Tilree the logs are lashed to bamboos with rope made of the "bauhimia" creeper, and experience has shown that a log of 50 cubic feet required 200 bamboos.

Each raft consists generally of about 600 cubic feet. They are floated down during the height of the rains, and the time occupied in transit is three or four days. There are four rapids, consisting of blocks of heavy rock, through which the river winds, extending over 10 miles. Some of these rocks have already been blasted, and the floating on this river can be further improved. At Mandla the rafts are broken up, the logs and bamboos are taken out, and after the end of the rains the timber is carted on Government carts, and the bamboos on hired carts, to Sukrighát, about seven miles from Mandla, the bed of the Nerbudda river between these two places being an irregular mass of rocks with a fall 40 feet high in one place, and the river therefore being at present impracticable for floating any but single logs of teak or other timber that will float. At Sukrighát the timber remains until the close of the ensuing rains, when the rafts are made up again and despatched to Gwarighát, a journey that occupies about six days. The best time is at the end of the rains in September, when there is a steady flow of water at a uniform level. The whole of these arrangements have been managed so economically, that the timber which is expected to be landed at Gwarighát in next October will not exceed 13 annas per cubic foot, and it is hoped that the cost will be still further reduced. This only includes actual working charges and does not allow for the proportion of the divisional and provincial establishment charges. If a cubic foot of timber from these forests can be delivered at Jabalpur for 12 annas, allowing for all establishment charges, it may be regarded as certain that a net profit of 4 annas at least may be realised on whatever quantity can be supplied. As regards the other forests, no attempt has yet been made to open proper communication; but it will probably be found possible to utilise the Halun and Phen rivers for floating purposes. The difficulty will be that there are not at present sufficient bamboos for this purpose in the eastern reserves. When these floating operations commence, it will have to be considered whether some bamboo forests on the Bormeyr river will not have to be taken up as forest reserves.

38. The peculiar feature of the Banjar reserve is its excellent soil, which, as far as we were able to judge, is the product of decomposition of large-grained gneiss. This reserve is surrounded by forest almost on all sides. On the north side some sál-producing forest has not been included, and here a revision of the boundary may perhaps be considered. We spent two days on its examination: Banjar reserve. General description.

the first, on the west side, entering near Sareka, and coming out again at Kisli; the second, in the centre and on the north side, going from Kisli to the Thana Depôt, and leaving the reserve near Soh village. Like all these sál forests, this reserve contains grassy plains of considerable extent along the valleys which interrupt the forest, but they occupy less than half the area, probably about one-third. In the western portion the sál trees form, as it were, standards in an underwood of tall and vigorous bamboos. The forest here resembles in its general character the mixed forests of the Continent of Europe, in which oak or Scotch fir forms one crop, with a second crop of beech forest underneath. The forest in this portion of the reserve is exceedingly dense, moist, and in every respect healthy and vigorous, and if by any practicable means a similar mixture could be produced in the whole of these reserves, it would be a great advantage. Besides bamboo the sál is mixed with a variety of other trees. The growth of bamboo in this part of the forest has doubtless been stimulated by the clearings made for beywa cultivation by the Baigas. When the bamboo is cut down for these temporary clearings, a dense mass of slender shoots springs up after the field has been deserted, and with it grow up coppice shoots and seedlings of other trees. After a few years the bamboo shoots gain strength and attain their full size, which in this forest is between 30 and 40 feet. The saplings of sál and other trees cannot keep pace with the bamboo at this stage, and remain for some time under its cover, but sál particularly stands a great deal of shade, and in the end it pierces through the canopy of bamboos, overtops them, and its crowns form a kind of upper storey in the forest. We discovered no instance in which the cover of bamboos was heavy enough to kill the sál. In many cases the flowering of the bamboo gives more room, and thus also assists the growth of the tree forest. Where sál grows up in the manner here indicated, mixed with bamboos, its stems are clean and straight, and they are not disfigured by the knots of side branches which are commonly seen in pure sál forest. In some cases, a mixture of other trees with sál has nearly the same effect as a mixture of bamboos. It was a great pleasure to see these beautifully mixed forests of the western portion of the Banjar reserve, and the sál and the bamboo will certainly improve by protection of the forest from fire. Even where the bamboo is less common, as in the northern portion of the reserve visited by us, it is to be found in all ravines; it is nowhere entirely wanting, and there is everywhere a large proportion of other trees. Bija sál is also found, but generally in small groups by itself. Near the streams here and in other sál reserves, there is a considerable quantity of Taur (*Bauhinia retusa*), which, however, in this part of the country is not tapped for gum.

Generally speaking, the character of the forest is very irregular, and apart from the open grassy plains, the following three main classes of forest may perhaps be separated at present. They are not, however, sharply defined, but there are numerous intermediate variations in the character of the forest,—*first*, bamboo forest mixed with sál as an upper tier or storey; *second*, pole forest mostly consisting of pure sál; *third*, sál forest of different ages with mature trees, and often more or less open. I do not think that it would be possible to indicate these three classes of forest upon the map, and we must at present be satisfied with indicating on the map the limits of the open grassy glades which are included within the reserves. It will, however, be possible in a general way to state which kind of forest predominates in each block. As fire protection advances, it will probably be necessary to divide the reserve into a number of blocks. The division lines should in all cases be so laid that they may be used either for local traffic or as cart roads for the export of timber. The selection of these lines will be a matter of considerable time and will require the greatest care. In the formation of these blocks, the utility of these lines alone should be considered, for it is out of the question to frame these blocks with reference to the character of the growing stock, or to its future treatment.

Plan of cuttings. Valuation surveys.

39. A large number of mature trees, many of them with tall clean stems exceeding 50 feet in length, may be cut in this reserve. Large trees for seed and shelter must, of course, be spared on the edge of all blanks and in very open incompletely stocked portions of the forest, but all large trees with spreading crowns in the midst of a pole forest and a large proportion of mature trees where

sál is mixed with bamboos, may be cut, and their removal will benefit the forest. Eventually, when experience has shewn that the cost of delivery of this timber at Jabalpur can be permanently reduced, so as to leave a margin for profit, it will be necessary to prepare a working plan and to take stock, probably by means of linear valuation surveys, of the mature timber growing in the different blocks. For the present, and as long as the question of a profit from these timber operations is uncertain, the preparation of a working plan and the taking of stock would be premature, and there are important operations to be done in these forests, the necessity of which is more urgent. At the present time, the working of the Banjár reserve is limited to the extraction of dead trees and dry timber. As under fire conservancy there is no risk of the destruction of this material by fire, it may perhaps be considered whether these operations may not be made more profitable by taking in hand a limited area every year, and by felling simultaneously with the extraction of this dry timber a small number of mature trees. The timber operations in these forests must for many years to come be on a limited scale, and must grow gradually, as the demand for timber at Jabalpur at remunerative prices increases. To guard against any over-cutting it might perhaps be fixed that no more than 400 mature trees in this forest should be cut annually, and this would probably for the present be a safe margin. It may be assumed that more than 15,000 acres are stocked with sál forest, containing on the average more than one mature tree per acre; and, considering the very large area of forest of the younger classes, it may also be assumed that the whole of the mature trees may safely be cut within a period of 30 years. This would permit an annual outturn of 500 trees.

It appears to me that the first work to be done, as soon as the 4-inch scale map has been obtained of this forest, will be to enter on the map the limits of the more extensive stretches of open grass lands, the second step to select and to lay down the division lines of blocks, and the third to ascertain from sufficient experience that the timber from this forest can be delivered at Jabalpur at remunerative rates, and to improve the means of transit so as to attain this end. After those three steps have been accomplished, fire conservancy having been maintained all the time, it will then be necessary to determine by valuation surveys the growing stock of mature timber and to lay down a plan of operations.

We have considered whether an attempt should be made to enter on the maps, besides the open grass lands, the limits of the sál forest and of such forest as is not stocked with sál. I do not think that this will be found practicable, and it will in my opinion be best to lay the valuation survey lines through the entire forest, excluding only the grass lands, the limits of which have been entered on the map and the area of which can, therefore, be ascertained. Great care must be used to lay the valuation survey lines through the forest in such a manner as to obtain fair average results which shall be applicable to the entire stocked forest area. Regarding the rate of growth of the sál tree in the forest, no information is as yet available. As far as we could judge of the ends of logs examined by us, the annual rings are fairly distinct, and the average number of rings seemed to be between five and eight on one inch of radius.

Works of improvement.

40. Besides fire conservancy not much work of improvement can be suggested at present. Excepting on ridges, and the tops of hills, the creepers are not bad in these forests. They must, of course, be cleared away, but that can be done by the local establishment. Thinning-out of other trees is not required; on the contrary, the mixture of other kinds with sál should, as much as possible, be encouraged. We have no experience on the subject, but it is not impossible that in an entirely pure sál forest the carpenter bee or other insects may be found to multiply to such an extent as to endanger the maintenance of the forest. It is believed that the larva of the carpenter bee lives in the bark of diseased trees, and it has been suggested that in complete pole forests of sál all suppressed trees should be thinned out, so that only the dominant and vigorously-growing trees should remain, in which the carpenter bee is not likely to breed. The experiment should be made; but the difficulty will be the disposal of these thinnings. Charcoal would not pay at present, and the people in the vicinity would not take the material away. If left on the ground, even if felled during the rains, the thinnings will greatly increase the risk of fires and may breed insects of other kinds. But, as stated above, the experi-

ment should be made in a well-defined locality, so that its effect can readily be watched.

Another experiment should be made in the Banjár forest, to test whether it would be advisable to stock grassy blanks by sowing sál on a large scale in places which are suitable for the production of sál. I suggest that lines, 25 to 30 feet apart, be prepared by ploughing or by digging up, interrupted where trees stand on the ground, and that the seed be sown continuously in these lines. These lines may also conveniently be formed of pits and plots dug up at distances of 2 or 3 feet apart.

One season's weeding will probably suffice, for sál seedlings stand a large amount of shade. The weeding and the general control of the experiment will be greatly facilitated by arranging these sowings in regular lines. Captain Doveton, in his excellent report on these forests of March 1875, draws attention to the fine specimens of tún at Khana, and suggests that this light and valuable wood might make excellent buoyage for carrying the sál by water, and might with advantage be cultivated in the moister localities, which are too damp for sál. This is an important suggestion which should be acted upon. The tún while young will require protection from frost. I suggest that it be planted in lines, which will greatly facilitate all arrangements for its protection. In accordance with what was said in the introduction to this report regarding the necessity of concentrating the work, I suggest that, for the next few years to come, the attention of the divisional officer be mainly directed to this reserve. It is that in which the principal timber works will for some time to come be carried on: the divisional officer, therefore, must often visit it, and fire conservancy, as well as other works of improvement, can, therefore, most efficiently and most conveniently be superintended in this reserve. I do not say that fire conservancy may not eventually be attempted in any of the other reserves. The question whether this is expedient or not must entirely depend upon the local subordinates that may be available for the supervision of this work. As the subordinates in charge of the reserves become more efficient, so that they can be trusted with the maintenance of fire conservancy, the extension of it to other reserves besides Banjár may be taken into consideration. But at first, I am certainly of opinion that all operations should, as much as possible, be concentrated in the Banjár forest, and the suggestions made with regard to work in other reserves must, therefore, be understood to refer to the time when the work in the Banjár forest is sufficiently advanced to justify the extension of operations to other reserves.

Keola Khapa forest.

41. The Keola Khapa forest is about 8 miles long, narrow in its northern part and broader in the south. With the exception of a small portion in the north, it is surrounded by open country. The portions stocked with forest are interrupted by extensive grass lands, which occupy probably more than one-half of the reserve. There is a continuous mass of forest both near the north and south end. We only examined the northern portion, in which two main classes of forest may be distinguished: poor and stunted forest on high ground (the rock being quartz and laterite) and forest of a better description on low ground (the soil being a light sandy loam overlying micaceous schist). The forest in the best portions does not much exceed 100 feet in height. The sizes of the trees may best be gathered from the following pattern trees which were measured :—No. 1, 2 feet 3 inches girth, and 68 feet high; No. 2, 3 feet 4 inches girth, and 79 feet high; No. 3, 4 feet 5 inches girth, and 100 feet high. In many places the forest is incompletely stocked, owing to trees having been felled formerly. Some of the stumps examined appeared to be over 30 years old, and seemed to indicate that at the time they were cut there were villages or Baiga settlements which required the wood for building or for other purposes. Mature trees are found here and there; one of the largest measured 9 feet in girth, with a straight bole to the first branch of 40 feet. These mature trees are said to be more numerous in the southern portion. When this forest is taken in hand, then the first thing to be done will be to enter on the map approximately the limits of the open grass lands, so that the area stocked with forest may be known. When the time comes to commence fire protection in this forest, it must be divided into blocks by cleared subdivision lines. There will be no difficulty in selecting these lines, as the reserve is traversed from east to west by four village paths, which may conveniently be

used for this purpose. The timber from this forest will have to be floated down the Halun river, which passes through it.

Sál is by far the most common tree. It is associated with small quantities of harra, mohwa, aoula, achar, palas, and dhobein; bamboos are found in the northern corner.

Topla forest.

42. This forest is estimated to contain 70 to 80 square miles, and is situated on both sides of the Halun and Kashmiri rivers. On the east and west sides it is enclosed by ranges of hills covered with poor forest, and probably consisting of trap. We only examined a small portion of it near the Halun river, in which the grass lands are very extensive and a great part of the older forest very open, as if heavy fellings had taken place. We measured one of the large trees left standing, 148 feet in height, with a girth of 9 feet. This part of the forest reminded me of the Doorgadeh forest in Kumaon, which was a completely stocked forest, until a few years ago all marketable first class trees were cut out, only bent, crooked, and undersized trees being left standing. These heavy fellings cannot, I understand, be attributed to the sleeper operations of 1869, but are entirely due to the Baigas, who cut extensive Bhewas and Dhyas in the forest, and who formerly were in the habit of cutting trees in order easier to collect the *rál* (dammar) on stems and branches, or for wax and honey, or for other purposes. The western part of the forest, which we examined, contains, however, extensive pole forests of various ages in which the trees are tall and have clean stems: one we measured was 75 feet in height and 3 feet 6 inches in girth.

Motinala forest.

43. The area is 1,600 acres. The reserve is bounded by the River Phen on one side, and by open country on the other side. The greater part of this reserve is stocked with sál forest, which in places is very complete, a few harra, aoula, saj, lendia, palas, and pandri being mixed with it. This forest contains a considerable proportion of large trees, and, wherever the ground is stocked with either poles or saplings, the sooner these large trees are cut out the better. The poles are tall and well shaped. The following trees were measured as samples:—No. 1, 77 feet in height and 3 feet 7 inches in girth; No. 2, 108 feet high and 5 feet 9 inches in girth. Several compact blocks of sál forest near Motinala, not yet included within the reserve, should be demarcated.

South Phen forest.

44. In this reserve the sál forest occupies the undulating ground which surrounds and separates a number of rocky hills, probably consisting of trap and clothed with bamboos, and scanty forest of other kinds. A large extent of the sál forest is well stocked with poles and a proportion of mature trees; but in many places the forest is open and incompletely stocked, owing partly to clearings for Beywa, partly to the practice of the Baigas, to fell sál trees for the sole purpose of scraping off the *rál* on the surface of the bark. In the midst of the forest we came across a hut put up last rains by the Baigas and found near it several trees which had been felled solely for that purpose. We also found a number of sál trees ringed, which operation causes the *rál* to exude from the portion denuded of the bark. It is difficult to understand that these practices can have reduced the forest to its present open and incompletely stocked condition. But so it is; there is no other explanation for it. The pole forests shew that this reserve can produce well-stocked forest. As instances of the size attained by the trees in the pole forests of this reserve, the following were measured:—No. 1, girth 4 feet 8 inches, height 85 feet; No. 2, girth 4 feet, height 88 feet, with a length of timber of 48 feet. Sál is mostly pure, with a small proportion of harra and pándri. The rock is frequently quartz on the ridges and here bears a forest of stunted character; but in a great part of the reserve the soil is a very deep light loam, apparently overlying micaceous schist, and in this part of the forest the ground is cut up by deep and irregularly ramified ravines with perpendicular sides. In some places sál was found on trap and on laterite. The timber from the South Phen and Motinala forests must be floated down the Phen river to the Bormeyr. The difficulty will be to provide bamboos for this purpose, for the bamboos are small in this forest and not very plentiful.

Establishment in the sal forests.

45. The present establishment stands as follows:—

The Banjar Reserve.

1 Jemadar on ... ... Rs. 25
2 Watchers at ... ... Rs. 7 and Rs. 6 respectively.

Keola Khapa and Topla.

1 Duffadar on ... ... Rs. 10
2 Watchers on ... ... „ 6 each.

South Phen, North Phen, and Motinala.

1 Duffadar on ... ... Rs. 12
2 Watchers on ... ... „ 6 each.

In addition to these one daroga on Rs. 60 is at the disposal of the divisional officer who is at present in charge of the timber operations in the Banjar reserve.

This establishment is not considered sufficient to ensure the bare protection of these forests. In the Banjar reserve it must be increased at once, and in the others gradually, as fire conservancy and other work is extended.

In the Banjar forest one ranger or daroga should, as at present, be in charge of the timber operations and the protection of the forest, having under him 1 forester and 4 watchers; the length of boundary to be watched is between 50 and 60 miles. A second ranger or daroga must eventually be appointed to the charge of the remaining reserves, and he should reside at Motinala. Under him should be one forester for Topla and Keola Khapa, with 3 watchers for the former and 1 watcher for the latter: one forester for the North Phen, South Phen, and Motinala, with 6 watchers. The cost of the existing establishment, compared with that here considered necessary, is shewn in the two statements below:—

Actual Scale.

			Rs.
Banjar ...	1 Daroga on ... ... Rs. 60	—	60
	1 Jemadar on ... ... „ 25		
	2 Watchers on Rs. 6 and Rs. 7 ... ... „ 13	—	38
Halun River ...	1 Duffadar on ... ... Rs. 10		
	2 Watchers on Rs. 6 each ... ... „ 12	—	22
Phen River ...	1 Duffadar on ... ... Rs. 12		
	2 Watchers on Rs. 6 each ... ... „ 12	—	24
	Total ...		144

The proposed scale will be as follows, on the assumption that the average rate of pay of rangers will be Rs. 60, that of foresters Rs. 20, and that of Watchers Rs. 7:—

			Rs.
2 Rangers on ... ... Rs. 60		—	120
Banjar ...	1 Forester on ... ... Rs. 20		
	4 Watchers on Rs. 7 each ... . „ 28	—	48
Halun River ...	1 Forester on ... . Rs. 20		
	4 Watchers on Rs. 7 each ... ... „ 28	—	48
Phen River ...	1 Forester on ... ... Rs. 20		
	6 Watchers on Rs. 7 each ... ... „ 42	—	62
	Total ...		278

This establishment is considered absolutely necessary in case fire conservancy is to be introduced in all these forests, but the increase may be introduced gradually as the work is extended, and when this establishment has been sanctioned and organised, the divisional officer ought to be able to maintain fire conservancy in all of these forests.

CHAPTER IV.

JAGMANDAL RESERVE.

General description.

46. This reserve was demarcated in 1865-66. It occupies a portion of the hills between Bichia and Ramnuggur, and is surrounded entirely by open country and málguzári forests. Its area is 24,500 acres, and the length of

boundary is about 41 miles, with 71 boundary pillars. They are conical masonry pillars, 6 feet high, on a platform 3½ feet square. They were erected at the time of demarcation, and have kept remarkably well. The boundary line has been cut all round, where it passes forest, to a width between 50 and 60 feet. Early in the season, about November, a strip 10 to 15 feet wide, along the edges of the forest, is cut, and the grass outside of it burnt several times, and in the beginning of the hot season, grass, bamboos, and shoots are cut over the whole width and burnt. Formerly the line used to be cut in its entire width. The málguzári forests, which adjoin the reserve, are fortunately mostly fired early in the season for the sake of the young grass, and this, in my opinion, is the main protection of the reserve. If the surrounding forests were not burnt until the hot season, it would have been extremely difficult, even with a very broad cleared and burnt belt, to prevent fire being blown into the reserve. Four footpaths pass through the breadth of the reserve, and are kept open for local traffic. The grass is cleared along them to a width of 10 feet, but is not burnt. No cheroot, hookah, torch, or other fire is permitted to be carried. The rock throughout is trap. As regards soil, there are two great classes; that on the hill-sides, a stiff ferruginous loam, with numerous stones and boulders, but generally deep; secondly, on the undulating ground at the foot of the hills, black soil with holes and crevices, and often large extents of sheet rock close to the surface. The character of the vegetation is exceedingly varied. On the hills, especially on the flats, ridges, and upper slopes of the hills, the forest is generally open, with grass between the trees and isolated clumps of bamboos. An exception to this is found on the highest tops of the hills, which are clothed with dense clumps of bamboo and scattered bija sál. The lower slopes of the hills are clothed with dense bamboo forest, which is generally more vigorous on the north side. The bamboo is the common bamboo (*D. strictus*), and the stems attain a length varying from 30 to 50 feet. The principal trees on the hills are teak, saj, tinsa, dhaura, lendia, tendu, and in smaller numbers are found bija sál, sewan, kusam, and dengan. In open parts of the forest there was a remarkably heavy underwood of sehora, the stems often attaining a girth of 12 inches and a considerable length. It may, however, be expected that, as the cover of the forest overhead gets thicker, this underwood will gradually die off, and a commencement of this process was noticed. Creepers are abundant on the hills, Bauhinia being the most common with a small quantity of Derris.

Hilly portion of reserve.

47. A high range of hills runs through the forest from east to west, rising to 2,731 feet in Jagmandal. In the vicinity of this range, and on northerly slopes and in ravines, the bamboo and trees attain a much larger size. In a few places mature teak trees of 5 feet in girth and upwards are found in groups, and with a careful selection a small number of these trees might be cut. Teak can be floated down by the nullah which passes Baisanda and flows into the Bormeyr, and by the Datta river, which flows into the Motigarce and thus into the Banjar. Large quantities of excellent bamboos might be cut with great advantage to the forest, because young teak in many places is kept down by bamboo, but there is no demand for bamboos from this reserve and there is no prospect of such demand, except perhaps eventually for floating down sál. On the hills all trees have benefited alike by protection from fire, and there is almost everywhere a good show of shoots from gnarled underground knots, the result of the action of jungle fires for ages. Teak coppice shoots from old underground stems are particularly numerous, and it may be said that the luxuriant and healthy growth of these has hitherto been the most signal effect of protection from fire. Less marked has been its effect as regards the production of seedlings. Teak seedlings, which have sprung up since fire protection commenced, are, it is true, numerous, particularly on the more open elevated flats; but these seedlings have been much impeded in their growth by the tall rank grass, and we noticed numerous cases of long, thin stems which had twisted round in their struggle to get up to the light. No more striking proof could be found of the fact that young teak requires much light for its development, while sál seedlings, for instance, thrive well under the cover of tall grass in the Sub-Himalayan forests. Vigorous seedlings of many other trees, such as bija sál, tiwas, dhaura, tendu, were observed in the midst of the grass, and they seemed to support its shade better than teak. In many

places young teak was found mixed with an underwood of sehora, and it is not impossible that an underwood of sehora is beneficial to the growth of teak.

Lower lands of the reserve.

48. It remains now to say a few words regarding the lower lands surrounded by the spurs of the main range. They are principally found in the southern portion of the forest, on either side of the Datta nala and its tributaries. These lands consist partly of stony, undulating ground, and of flat portions with black soil, broken up by a few ravines. Before the forest was reserved, many of these flats were cultivated, often not permanently, but occasionally in an irregular manner. With few exceptions they are stocked with open forest, of which the principal trees on heavy binding soil are saj and mohwa, while on the stony ground teak, bija sál, and bamboos are more common.

We have carefully considered whether any of these open places should be sown. As a general rule, the principle doubtless is sound that, whenever a forest is protected from fire, every effort should be made to stock it completely. On the other hand, the limited forest staff in the Central Provinces makes concentration of all such efforts imperatively necessary, and there are other reserves, more easily accessible, and from which the produce can be exported at less expense, which more urgently demand the cultivation of teak and other valuable kinds. We have therefore without hesitation come to the conclusion that the work of improvement in the Jagmandal reserve must at present be limited to fire protection. There is, however, no reason why the forester in charge, who takes a great interest in his reserve, should not endeavour to improve his forest by cutting creepers and by clearing the grass from around teak seedlings, as far as this work can be done by the regular forest guards, and by a small outlay on coolies every season.

Prospect of revenue.

49. In 1863, before the reserve was demarcated, upwards of 7,000 teak trees were girdled in Jagmandal, nearly the whole of which have been removed. The remainder of the old timber left in the forest is now being cleared out; a few thousand cubic feet have been taken out this season, and there may be a few thousand left in the forest, but this and the cutting-out of a small number of mature trees, where they may be found, will be the only source of revenue for the present.

Establishment.

50. Jagmandal and Choárighogarh (2,300 acres) are in charge of a forester on Rs. 35, with 4 permanent and 2 temporary watchers in Jagmandal and 2 in Choárigogharh. This establishment seems sufficient for the present. The forester should also be made responsible for the protection of the Ahiri reserve (1,800 acres) in the Delta of the Halun and Bormeyr rivers and for the maintenance of its boundaries. Choárighogarh has been preserved from fire as long as Jagmandal.

CHAPTER V.

General description.

51. The Barela reserve occupies about 10 square miles. A map of the reserve will be prepared by the Topographical Survey, but was not completed at the time of our visit. The eastern portion consists of an undulating plateau, in a great portion of which the rock is massive trap close to the surface. The western portion consists of several valleys which run from this plateau, and the ground is more broken. The rock is trap throughout; where massive sheet rock is close under the surface the vegetation is very poor, and the bamboos and trees are dry at this time of the year. Where the rock is amygdaloid and the soil deeper, the ground is moister, vegetation is better, and bamboos and most of the trees are green at this time of the year. A large proportion of the area, both on the plateau and in the valleys, is open grass land, frequently traversed by narrow belts of forest. The slopes of the plateau and of the valleys are stocked with bamboo forest, in which teak is the principal tree. A few gnarled trees, with short stems and girth of from 5 to 6 feet, are found; otherwise the crop of teak consists entirely of poles and saplings not exceeding 50 feet in length. We noticed that a large proportion of these bore seed. This of course is mainly due to the fact of their being coppice shoots, but it appeared to me that a much larger proportion of poles and saplings in this forest bore seed than for instance in Jagmandal, and in the Satpura reserve. In places, in

the stiff soil, there was besides teak a great deal of sáj; otherwise mohwa was perhaps one of the more common trees associated with teak. Bija sál is found in places, and if the grassy slopes on the top of the hill which have a sufficiently good soil are ever planted up, this should be done with Bija sál. Kusam is found here and there. It produces lac naturally, and on some trees it has with success been propagated. Kusam is not, however, sufficiently abundant here, nor does it grow sufficiently well to justify the establishment of kusam plantations for lac in this reserve. Sewan is also found, and a few large specimens of dengan, with stems 3 feet in girth, were noticed. Of other trees it should be mentioned that there is a larger proportion than usual of haldu, associated with teak.

Fire protection.

52. Fire protection was commenced in this reserve in 1872. The boundary line is kept clear to a width of 30 feet, on the inner 6 feet of which the grass is cut early in autumn, and burnt repeatedly during the dry season. Besides the outer line a number of old paths running through the reserve are kept clear; many of these meet at one point in the centre. These paths, as cleared at present, would not prevent the spread of fire from one compartment to another, but they would, in case of accident, facilitate the extinction of the fire, and they certainly greatly facilitate the work of inspecting the reserve. The effect of fire protection has here, as in other forests, been most marked in the case of the stock existing on the ground at the time it was commenced. Along the edge of all forest belts the ground is full of coppice shoots of teak and other trees which have come up from underground stocks, and the growth both of poles and of bamboos has evidently been favoured by fire conservancy. Seedlings. however, are not wanting; seedlings of teak and of other trees are abundant in places on the edge of the forest. We examined numerous teak seedlings which had sprung up after fire protection had commenced, and we found that in their case also the growing stem had been killed several times before the present stem came up. In the case of these seedlings, the root is a thick fleshy tap root, somewhat resembling a wild carrot, and on its top are frequently to be seen the remains of several stems. It seemed to me as if the seedlings of bija sál and haldu were, upon the whole, more robust than those of teak, but I did not notice in this reserve the same proportion of teak seedlings, with long slender twisted stems caused by their seeking the light through the grass, which I noticed in Jagmandal. It may be that the grass is less heavy here than in Jagmandal.

Revenue.

53. No revenue has, since the protection of the reserve, been realised with the exception of this year, when a small quantity of harra was collected departmentally and sold. Grass is abundant, but there is no demand for it whatever, nor is there any demand at remunerative rates for bamboos. The western portion of the reserve adjoins the open country of the Jabalpur district, and it may be hoped that eventually grass and bamboos may be sold. Two nalas which might possibly be used for the floating of bamboos run from this forest, one northwards to the Gour, and the other southwards to the Nerbudda. Should bamboos and grass ever be carted to Jabalpur, the Mandla road, which is from 8 to 10 miles distant from the limits of the forest, will probably form the outlet. It may also be hoped that mohwa will eventually pay, and some revenue can doubtless be obtained from lac and harra. Numerous old trees of bahera, haldu and other kinds are scattered through the forest. Those few cases excepted, where they stand in the midst of grassy plains, they should be cut out to give room to surrounding young forest; there is, however, no immediate prospect of this wood being utilised, and it will have to be considered whether such old trees should not be girdled in order to get rid of them. Some time hence this forest will yield a fair quantity of teak poles, but not at present. The actual cost of the protection and management of this reserve stands as follows:—One duffadar on Rs. 15 and 4 watchers, whose pay aggregates about Rs. 26. Total nearly Rs. 500 per annum. Besides this, the cost of cutting and burning the lines, and of the extra hands entertained during the hot season, is about Rs. 250 per annum, so that the total outlay incurred on this forest is over Rs. 700 annually. It obviously is very important that the revenue realised from this reserve should be made to cover this outlay. Beyond the continuance of fire conservancy, I do not recommend any works of improvement in this forest at present. What seems more important than anything else is that

some tracts of unreserved forest in the vicinity, which contain very much better soil and very much better forest growth should be added to it.

It is difficult to understand the principles on which the selection of the Barela reserve was made. A large portion of it is on unproductive sheet rock; and the good portions are certainly not better, and probably worse, than many tracts of unreserved forest in its vicinity.

CHAPTER VI.

SINGRAMPUR RESERVE.

General description.

54. This reserve covers 6,555 acres. It is situated on the line of watershed between the Hiran river (which runs into the Nerbudda) and the Goorach (which joins one of the feeders of the Jumna); and it occupies a portion of the northern edge of the extensive Bhanrertable-land, the highest point of which, the Kalumar hill, distant 3½ miles south of the reserve, rises to 2,544 feet. The reserve includes the hills which are crowned by the ruins of the old fort of Singorgarh and a considerable extent of hilly ground to the north of the Jabalpur and Damoh road.

The following remarks are based upon a careful examination of the northern and southern portions, made on the 12th and 13th March. We have also consulted a report on the forest and suggestions for its treatment, drawn up by Messrs. Moore and Hooper in September 1873. The configuration of the ground is clearly shewn on the 1-inch scale map prepared by the Revenue Survey Department in 1855-56, long before the reserve was demarcated. The length of boundary is 20 miles, with 45 masonry boundary pillars, which are whitewashed every year and on which the numbers are painted afresh after whitewashing. The boundary line is kept perfectly clear to a width of 60 feet, and in no other reserve have I seen the stumps of the trees on the lines so completely killed as in this.

Fire protection.

55. The forest has been protected from fire since the hot season of 1871. Every year in autumn the grass is cleared on a narrow strip of seven feet outside the edge of the forest; the cut grass is burnt, and the line is burnt several times. At one point only, at the foot of the hills near Pahareepur, had the line not been cleared at the time of our visit. The Málguzár of Singrampur had obtained permission to cut and utilise the grass on this portion; he had only cut it partially and there seemed to me to be great risk of fire. The protection has been complete with a few exceptions, the most notable being that in 1875 a piece in the block north of the road was burnt by the men of a detachment of a European regiment, which was on its march from Saugor to Jabalpur. I would suggest that the duffadar in charge of the forest should have a copy of a notification in English warning all travellers of risk from fire in this forest.

Rocks and soil.

56. Geographically, the reserve divides itself naturally into 3 great blocks or divisions—

First,—The plateau, including the Singorgarh hill, the highest point being the Bhagny hill, a few hundred feet lower than Kalumar;

Second,—The valleys on both sides of the plateau and the plain between it and the Jabalpur road;

Third,—The northern portion north of the Jabalpur road.

The rocks in the whole reserve are stratified, the strike being from west to east, and the dip to the south. The dip is very slight on the plateau, where the strata of sandstone are almost horizontal, and much greater in the northern part of the reserve. The sandstone of the plateau is of a reddish colour; most of it is massive, alternating with laminated and more or less argillaceous strata. Underlying this sandstone are a variety of calcareous and argillaceous shales, the former generally grey, the latter of reddish colour. These calcareous and argillaceous strata predominate on the north face of the low range of hills, north of Singrampur and the Damoh road, and they appear in a beautiful section, of a perpendicular rock about 60 feet high, which is called Deodant.

57. As regards the growing crop, the general character of the forest is extremely poor and disappointing, and it is not clear on what principles this reserve was selected, considering that there is unreserved forest of more promising character in the vicinity. That portion of the reserve which is on the plateau was formerly cultivated; in places it bore rabi crops, but most of it was kharif land. Growing stock.

Here the almost horizontal strata of the sandstone lie close under the surface, and the trees which grow upon it are with few exceptions stunted. This part appears much better fitted for the plough than for syloiculture. Exceptions are the low hills which rise from the plateau, such as Bhagny Point, where the soil, though exceedingly stony, is deep and moist, and the forest very promising, containing teak poles of good size and straight growth. On the shallow soil of the plateau I noticed a large proportion of ghoti (*Z. xylopyra*), with an abundant crop of lac, which, however, is much less valuable than the lac of either chiula (*Butea*) or the kusam.

Forest of a similarly open and stunted character occupies the southern slopes of the hills north of Singrampur and the road. Here the strata of the rock, which have a considerable dip to the south, are also parallel to, and close under the surface of, the slope of the hill, and the consequence is a wretched open forest of saler and kurlu, with a few stunted specimens of dhowra, teak, and other trees, frequently with dead stems or tops. Besides the plateau and the southern slopes of these hills, there are other portions of the hills with an equally poor vegetation, and it is not too much to say that more than one-half of the reserve is stocked with forest of a most unpromising character. The most valuable part of the forest consists of two valleys which rise from the Singorgarh hills; one running due east, and the other, which drains the tank and passes by the old palace, opening out in a north-easterly direction. These valleys are stocked with teak coppice mixed with other trees, which in places is complete and attains an average height of 40 to 50 feet. There are also good teak poles in the ravines at the foot of the plateau, on its north-west edge, in a few places near the Jabalpur and Damoh road, at the foot of some isolated hills near a tank in the north-west corner of the forest and on the north face, at the foot of the hills which are situated due north of Singrampur. But the agregate area of promising teak coppice does not probably exceed 2,000 acres, including that on the Bhagny point.

Next to teak, the most valuable product of this reserve is bamboo, but unfortunately it is only found on a limited area, *viz.*, in the ravines at the north-west foot of the plateau, and on the north face of the hill north of Singrampur. The bamboo here has in former years evidently been over-cut. It is now recovering under protection from fire and from cutting, and numerous fresh shoots of last rains were noticed, two inches in diameter and 25 feet high. In both places bamboo is mixed with teak.

58. The general appearance of the forest at this time of the year is extremely dry. In Barela, on trap only 50 miles south-east of this which we examined a few days ago, a large portion of the forest, including the bamboo, was perfectly green, and those places only were dry and leafless which are on sheet rock or otherwise in dry stony places with shallow soil. In Singrampur on the other hand the leaves of all bamboos are dry and falling. It must not, however, be forgotten that the winter is colder here than at Barela, and that this may have something to say to the earlier leaf-fall. The following trees, however, were still in leaf:—1*st*, tendu; 2*nd*, jamrassi; 3*rd*, chiula (*Butea*); 4*th* nim, (of which a considerable number are scattered about); 5*th*, pakra (*Gardenia latifolia*); 6*th*, mohwa; 7*th*, haldu; 8*th*, mundi; 9*th*, kusam. In most places the teak had also retained some of its leaves, and kowah near streams was as usual in full foliage. Dry character of the forest.

59. It has been mentioned that the climate is colder here than at Barela. Frost in low and badly-drained places is certainly much more injurious. All along the valley which passes the hill of Deodant the forest had suffered most severely from frost, and particularly from a severe frost which happened in January 1875. The tops of many trees had been killed, and the stunted stems had produced thick heads of pollard shoots. The following trees had suffered most: chiula, ghoti, saja, teak, bahera, kainkra, lendia, babúl. Frost.

Tendu and khair had suffered less, and kowha, ber, gurar, dhamin, and karounda had not suffered at all.

Future treatment.

60. We have carefully considered whether it is expedient to continue the annual outlay which is now incurred on the management and fire protection of this forest. This outlay amounts to about Rs. 700 a year, *viz.*, pay of duffadar and 3 permanent forest guards Rs. 432, pay of temporary fire-guards and other outlay connected with fire conservancy Rs. 270. The revenue which this forest yields at present consists of Rs. 20 per annum, which is paid by the Dhimars for the use of the Singorgarh tank for the cultivation of the Singhara nut. If there were more prospect of stocking a proportion of the reserve with valuable forest, the outlay, even without any corresponding revenue, would be perfectly justified by the gradual improvement of the capital value and the productive powers of the forest. But, although some improvement doubtless takes place year by year over the whole of the forest, yet it is not likely to be considerable, except over an area of about 2,000 acres. On the other hand, the situation of the forest for export and utilisation of its produce is very favourable. Though, therefore, we cannot hope ever to produce large timber in it, we have come to the conclusion that the idea of abandoning fire protection must not be entertained. Under these circumstances it seems necessary to devise some sources of revenue which will cover the annual necessary outlay. Grass it will probably not be possible to sell for some time to come, but grazing, even during the rains and the cold season, is eagerly demanded, and moderate rates would readily be paid by the cattle-owners. This, however, would, as far as our present knowledge goes, put reproduction by self-sown seedlings out of the question, and we do not therefore recommend the experiment at present. I do not, however, deem it impossible that some time hence certain portions of this forest may be opened for grazing, fire protection being maintained all the time. Some revenue may be made from mohwa and lac. Lac is found both on ghoti and chiula, and the duffadar has been successful in propagating it, but he stated that he had no seed lac for kusam. An attempt should be made to utilise the kusam trees in the reserve for the same purpose. Some revenue may also at once be made by cutting out teak poles and by cutting over badly-grown teak coppice. In places, particularly south of Ghoorkea village, there is a considerable extent of pure teak pole forest which might be thinned with great advantage to the growing crop. The duffadar takes great interest in his revenue and has been in charge of it for years. The manner in which he has organised fire protection seemed judicious, and on this account also it is most desirable not to interfere with the maintenance of fire protection. It doubtless will be found possible to produce sufficient revenue to cover its cost, and perhaps even to leave a balance which may be expended on other works of improvement. Of these works of improvement, the principal one appears to be the cutting of creepers, which are numerous (*B. superba*, *Derris scandens*, *Vallaris dichotoma*, and *Ventilago calyculata*). In the more promising portions of the forest all creepers should be cut as soon as possible. Teak, though a valuable tree in this part of the country, does not by any means attain a vigorous growth in this reserve, and I am not in favour of extending it by sowing or planting. I find a suggestion in Moore's and Hooper's report that the northern sissoo should be cultivated. This tree does not suffer from frost in the Punjab, is easily cultivated, likes a sandy soil, and will probably thrive remarkably well in the few moist places in the forest; but it demands much moisture, and the greater part of the forest would be too dry for it.

As soon as the needful funds are available, experimental nurseries of sissoo should be established, and if it should be found to succeed, it should be sown or planted in lines, which may be either continuous or made to consist of a string of plots, the distance between the lines being from 15 to 30 feet apart, so as to reduce the expenditure. In the report already quoted I find proposals regarding the treatment of certain blocks of the reserve for conversion into high forest and of others as coppice with standards. Proposals of this nature in a forest of this description are in my opinion entirely premature. The growing stock of the Singrampur reserve is so poor at present that no plans regarding its future treatment can be formed. The main problem to be solved at present is how to make both ends meet and how to cover

the cost of management and fire protection. Meanwhile, if the officers in charge have time to spare, they should devote it to the examination of the unreserved forests in the Damoh district, with the view of deciding whether additional reserves should not be demarcated with soil and forest more promising than that of Singrampur.

CHAPTER VI.

BIJERAGHOGARH SÁL FORESTS.

General description.

61. There are three reserves, *viz.* :—

Khitoli, 9,651 acres.
Machmacha, 8,737 acres.
Sutri, 2,800 acres.

A general account of these forests having been given in the printed report by Messrs. Fernandez and Smythies of September 1874, it will not be necessary here to do more than to give a description of the localities visited by us and the observations made. Each reserve has been divided in the report quoted into compartments marked by letters, and it will suffice to quote these in the following remarks.

The boundary lines of this reserve are completely cleared to a width of 45 to 60 feet. The reserves have been protected from fire since the rains of 1871, and this has been effected by cutting the grass on a belt 10 feet wide along the inside of the boundary line and by burning the cut and standing grass when sufficiently dry. The burning this year was accomplished in 12 days, between the 15th and end of February. An attempt has been made to plant a hedge of saler and thūr (*Euphorbia*) on a length of 4 to 5 miles on the north-western boundary. The object was to prevent more effectually the ingress of cattle, and to avoid complaints against the pounding of cattle which was frequently necessary when the forest was first closed. Many of the saler cuttings have struck, but I am inclined to think that in this reserve a thick belt of karounda (*Carissa diffusa*) will be found to form a better hedge. But now the necessity for a fence has ceased, because the closing of the forest is recognised and trespass rarely occurs.

Khitoli southern portion.

62. On the 19th March we saw a portion of compartment R., in the southern part of Khitoli along the Bagdarra road, and returned through compartment E. The forest in the vicinity of the Bagdarra road on the high ground north of the Badar nala is exceedingly poor, the sandstone is close under the surface, and the trees are few and stunted. A number of poles of tendu and sál had dry heads, with the appearance as if they had been cut down by frost, though it is difficult to understand this in a locality which is high and dry. The absence of soil may have something to say to this, by rendering the trees more susceptible to the effects of cold. Near the river the effects of frost were undoubted; but on the other hand the soil is deeper and better here, and the growth of sál poles very satisfactory. Compartment E consists of two portions, the northern being occupied by a flat plateau with scattered trees and grass about 2 to 3 feet high. Under the shelter of the trees are the usual groups of saplings and in the open numerous clumps of coppice shoots of lendia and groups of tendu shoots, many of which are root-suckers. Sál is scattered on this plateau; nevertheless we noticed a number of seedlings in the grass, 2 or 3 years old, both on the edge of the forest and out in the open, and these seedlings were in no way less vigorous than those which were found under the cover of the forest. This portion of the compartment will doubtless in course of time be filled up naturally, but the principal tree will not be sál, which will hold a subordinate place in the forest here.

Far superior in character is the southern and south-western part of the compartment. Here the ground is stony and here and there undulating. It is incompletely stocked with a mixed forest, in which, however, sál is the principal tree. As regards age there is great variety; groups of poles are found here and there, but older trees are more numerous. A small proportion of these are

above 4 feet in girth, but the majority are smaller, and the average height of the middle-aged forest may be taken at 60 feet. The other trees are those ordinarily associated with sál with a few bamboo clumps, the shoots of the last two years being of a fair size.

Character of sál seedlings.

63. Under the imperfect cover of this forest the ground is stocked with an abundant crop of seedlings from two to four years old. We examined a large number of these seedlings and found that in every case the original stem had died off, and we also found the remnants of dead stems of succeeding years. The leaf-bearing stem visible was in every case entirely the formation of last rains, and in many cases there were two or three leaf-bearing stems from one root. In this dry sandy soil the natural seedlings of sál send down tap-roots upwards of 2 feet long, which are thick at the upper end, though not as fleshy as the tap-roots of natural teak seedlings in the dry forests of the Central Provinces which we have lately examined. Each succeeding leaf-bearing stem increases the thickness of the upper end of the root and leaves its mark when it dies off. The result is that the upper end of the root is covered with numerous scars and the dry stems of previous years. Now to the cause of this regular and apparently annual dying-off of the young stems of seedlings. Fires have not occurred in this part of the forest since 1872, nor can the phenomenon described be the action of frost, for it was noticed quite as much on dry and high ground, as well as under sufficient cover, to form a complete shelter against frost. In fact, it was noticed in all portions of the protected sál forest alike. The only explanation that suggests itself is that these young stems in this description of soil are unable to withstand the hot sun and dry air of March, April and May, and that, as they die off, the lateral buds which are very numerous on the upper part of the root develop into fresh stems. It is a very interesting question, which should be inquired into in other sál forests. So much is evident that sál seedlings in this forest, though carefully protected from fire, receive numerous checks in their life before they make a final start. How long these seedlings will require to attain a height of 2 or 3 feet, and what proportion of them will survive up to that age, we do not yet know, but it seems to me probable that five years hence this portion of compartment E will be one dense mass of young sál, and will be sufficiently advanced to justify the thinning-out of a considerable proportion of the older trees which overtop it. When the young growth is sufficiently complete and advanced, then all marketable trees may be cut out, not only in order to produce revenue, but in order to obtain young forest of a complete and uniform character. When that time arrives, the growth of the forest will be much benefited by the cutting-out of all spreading trees which cannot from their shape form an integral part of the young growing stock.

Khitoli, northern portion.

64. On the 20th March we entered the reserve by the path which begins between boundary pillars 50 and 51, and leads north-east into Rewah. The path separates compartments R and S, O and T, and afterwards runs through V. The whole of this part of the reserve is a plateau formerly cultivated, which very much resembles the northern portion of compartment E. The soil is ferruginous sand, indurated near the surface, and in places the rock is close under the surface. In places there is merely a hard crust, which is perfectly soft in the rains. The open grassy plain is interrupted partly by isolated trees, principally of mohwa, around which is the usual growth with a large proportion of seedlings and by irregular belts of young, fairly well-stocked forest, consisting of poles of dhaura, lendia, tendu, with here and there a large proportion of saler, but very little sál. Among the grass, seedlings of saj are common, and wherever there are seed-bearing trees of sál, seedlings of this species are not wanting.

There is every prospect of this part of the plateau getting gradually stocked by coppice shoots, root-suckers, and self-sown seedlings. The process will be a slow one, and the proportion of sál will be insignificant. So that, whenever planting operations in this reserve can be commenced, this will be the place to sow sál in the open grass lands. After entering the compartment marked V, we turned off from the path in a northerly direction to the table rock on a sandstone cliff called Chatai Pat. The strata of sandstone, which are here horizontal, are hard, white, fine-grained, alternating with soft, coarse-grained rock, which is worn away by the action of water. The table is a flat piece of the hard-grained rock, supported by an irregular column of the soft sandstone.

The forest around this place consists principally of bamboos, with middle-aged sál and other trees, among which there is a large proportion of dhobain and a few specimens of *Strychnos potatorum*, which runs up to 4 feet of girth. In this part of the reserve there is also some satin-wood, but not of large size. The bamboos evidently flowered a few years ago over an extensive area here, and a young crop is now coming on. The stems of mature clumps are under 20 feet in length and not of any considerable girth; but one stem was found 2½ inches in diameter, and their size will doubtless improve as fire conservancy continues. It is, however, questionable whether the bamboos of the Khitoli reserve can compete with those brought to Allahabad from other sources. Good bamboos of this species command from Rs. 35 to Rs. 40 per 1,000 at Allahabad, and the question whether this will leave a sufficient margin of profit will entirely depend on the cost of carriage by rail. At present the cost is Rs. 44 per 100 maunds, which would be about Rs. 22 per 1,000 bamboos. The soil in this part of the forest is extremely dry. All bamboos, and most of the other trees were dry and leafless at the time of our visit. Seedlings of sál, however, are not uncommon. There were many bija sál trees in compartment V, and a good proportion of bija sál seedlings. Those which we examined shew a bend at the crown of the root, which thickens and afterwards gives the head of the root a bulbous appearance. No remains of dead stems of previous years, as in sál, were, however, noticed. We returned to Khitoli through compartments T and X. A great portion of compartment X is an open maidan, formerly cultivated; and the rest of it, as well as the northern part of T, consists of grass lands, interrupted by irregular belts of forest, with bamboo and sál of different ages. The ground is in places broken up by ravines, and here khair and rohun are common. Bija sál is found in compartment T, but sparingly in X. Around isolated trees, seedlings of mohwa and saj are common, and so are seedlings of sál in the vicinity of forest belts containing that species. In the open grass lands, seedlings of saj are common in patches.

Machmacha reserve.

65. On the 21st March we went through the Machmacha reserve, entering it from Karela village in compartment E, and passing through compartments F, H, málguzári lands of Barwáni, compartments O, L, K, A and A¹, and saw a small portion of it on our way from Birolee to Koonwan village. In the parts of the reserve visited by us to-day we came through a promising forest of sál poles, which forms narrow belts on the western side of compartment E. The eastern portion of compartment F, and that portion of H through which we came, is broken raviny ground with poor soil, incompletely stocked with khair and rohun. As soon as we crossed the boundary line and came into the málguzári lands of Barwani village, we came upon an unbroken stretch of level ground with excellent soil, formerly covered with sál forest, but now cleared for cultivation. Compartments O, L, and K, situated west of Papihi nala, are level, with ravines only near the river. Formerly a great portion of them was cultivated, and they are now stocked with isolated groups of mohwa and other trees, from which tree vegetation is gradually spreading into the grass lands; in ground broken by ravines, khair, rohun, birli are common, and in such places seedlings of khair and rohun are abundant, while on the level flats seedlings of saj and sál in the vicinity of that tree are more common. In the northern part of compartment K, near the old village site of Luckimpur, we saw the largest sál tree we had hitherto observed, 10 feet 8 inches girth, with a considerable height of stem. Parts of these flats are full of holes. The greater portion of compartment A is well stocked with a forest of sál poles, the larger averaging 40 feet high, and varying from 1 foot 6 inches to 2 feet in girth; the ground under the poles and in the small glades between is well stocked with seedlings of sál. With sál are associated here achar, dhaura, khair and saler, most of which form poles like the sál; these form an integral part of the pole forest and should be allowed to grow up with the sál. It is different with the large spreading trees, principally of mohwa. These interfere with the uniform development of the pole forest and should be cut out if the wood can be utilised; otherwise they might be girdled. The western cover of compartment N is broken, rocky ground, with stunted poles of sál, which extend southwards into compartment D, where the pole forest is more promising. This is almost the only place in the reserve where the rock is on the

surface; here it is a reddish ferruginous sandstone. The soil in this reserve is generally deep, with beds of gravel and blue clay, and deposits of kankar. The total area of this reserve is 8,700 acres. Our information is not sufficiently complete to form an exact estimate of the area stocked with sál poles, but it probably does not exceed 1,500 acres. Although the present growing stock is poor, the soil is, upon the whole, more promising than in Khitoli, and when the time comes to cultivate sál the commencement will probably best be made in this reserve.

Sutri reserve.

66. On the 22nd March we examined Sutri reserve, passing through it along the path from Saleya to Sutri, which leads through a fairly well-stocked portion of the forest. The soil is deep and apparently a rich sandy loam, capable of producing good forest of khair and rohun, and perhaps even of sissoo on the lower ground, and of sál where it is sufficiently dry. This portion of the reserve is at present stocked with a forest composed of trees of different ages in irregularly-shaped belts and patches. Sál forms, where it occurs, open and incompletely stocked groups of poles and saplings. The larger poles are from 30 to 40 feet in length, and with a girth between 12 and 20 inches. The larger poles must have grown up closer together than they stand at present, and it seems probable that previous to the demarcation of this reserve there have been heavy thinnings of sál poles. In Sutri, as well as in the other Bijerághogarh reserves, it was noticed that a large proportion of the poles were profusely covered with flowers, the top branches being all flower-bearing. In some cases it is true the leading shoot bears leaves and then the growth in height does not suffer; but upon the whole this early flowering of young sál trees is not an indication of vigorous growth.

Here and there larger sál trees are found in this reserve, mostly with spreading crowns; these, however, it will in most cases be necessary to preserve as seed-shedders. Besides sál, mohwa, saj and chiula are probably most common trees. Of seedlings, those of saj are most common. They are abundant all over the portion of the reserve visited, and have in places nearly attained the height of the grass. In such cases the top leaves were always found dry, which is probably due to frost. In a few years, however, the fresh shoots of these saj seedlings, and the numerous coppice shoots of this species will probably have overtopped the grass, and have established a young forest in its place. Seedlings of sál are not as much advanced as those of saj, but they are numerous wherever there are seed-bearing trees. We noticed much lac on chiula, some of which had been produced artificially.

General remarks.

67. The establishment at present maintained for the Bijerághogarh reserves consists of 1 jemadar on Rs. 25 and 7 watchers on an average of Rs. 7, and, besides these, 15 fire-guards are entertained during the hot season. The total expenditure may be put down at Rs. 1,200 annually. At present no revenue whatever is realised from these forests, and the most important question at the present time is to determine what course may be taken to cover the annual expenditure on account of these forests. Lac from *Butea* is probably the only possible source of revenue at present. The lac it is proposed to collect departmentally for sale, and a commencement has already been made. There is no reason why in the case of a product as valuable as lac this plan of departmental working should not be followed, which answers remarkably well in the case of sandalwood in Mysore. It must not, however, be forgotten that sandalwood has always been, and still is, a monopoly in Mysore, whereas lac is not a monopoly at all in the Central Provinces. With regard to other sources of revenue, the immediate prospects of revenue are not favourable. The bamboo of Khitoli is improving rapidly, and a considerable quantity might be cut annually if there were any prospect of selling at remunerative rates, which we do not see at present. Large trees, with spreading crowns, of mohwa, saj, and other kinds might be cut out with great benefit to the forest, but there is no demand at present for such wood, although 10 years hence a demand may arise. A limited number of large sál trees still remain in some compartments of Khitoli, but even these cannot, as explained, be utilised immediately. The first thinning of sál poles must also be deferred for the present, so that in the matter of timber and bamboos there is no prospect of any immediate revenue. If iron-smelting should extend, which it possibly may, and the mál-

guzári forests from which the charcoal is at present obtained be exhausted, this may create a demand for charcoal; but this demand also does not exist at present. It is impossible to go through the extensive blanks covered with grass in these and in other reserves of the Central Provinces without contemplating the utilisation of this grass for fodder. It would be necessary to cut it in September when it flowers and to export it as hay, but there would be great difficulties in drying it, and in obtaining the needful labour for the purpose; besides which the cost of carriage would be prohibitory. For the present, therefore, lac remains the only source of revenue from these reserves, and every effort should be made to increase its production.

The protective establishment of seven forest guards maintained under the jemadar seems to me to be somewhat high in proportion to the extent of these reserves. The aggregate area of the reserves in the Central Provinces is now 2,300 square miles, and for this area the revised scale of forest establishment only provides 135 forest guards, or less than one man for 16 square miles. At this average rate Bijerághogarh ought only to have two forest guards at the outside. But two men could not possibly be held responsible for the protection of the three blocks here described, and as long as lac has to be propagated and protected, I am not disposed to urge the reduction of the number at present maintained. The protection of the reserve is at present complete, and this is a great step gained, which at first was not easy. But there is no doubt that, as long as the maintenance charges are not covered by revenue, the utmost economy must be exercised. Had the timber, which was cut in these forests to provide sleepers for the Jabalpur branch of the East Indian Railway in 1860-64, been spared, they would now be in a position to yield a fair annual revenue to provide for maintenance charges, and their management would leave a considerable margin of profit. But in their present exhausted state the prospects are as already stated. As regards operations of improvement, I do not recommend that any experiments requiring considerable outlay be undertaken here, unless it is certain that a competent officer will be available for their supervision; but there are certain works the success of which is assured, such as the propagation of lac and the cutting of creepers; these can be entrusted to the local establishment and should be carried on to the greatest extent possible. Nor would I object to the forester in charge being directed to make experimental sowings on a small scale of the trees most likely to succeed and most likely to be valuable, *viz.*, sál, khair and rohun, each in the kind of soil suitable for it. But I would insist that these experiments be confined to one locality, and that the sowings be made in lines, which may be either continuous or consist of distinct plots, so as to facilitate weeding, filling up of blanks, and the control of the work. For the same purpose small quantities of sissoo seed from North-West India might also be placed at his disposal to be sown in suitable places on moist sandy ground.

APPENDIX.

I.—Extract from Journal of tour of Inspector-General of Forests through some of the Forests in the Central Provinces in February and March 1876.

February 9th.—Lakhnadon to Chapara going round east of the road, and near the junction of the Bijna and Wainganga rivers, *viâ* Sarusdole, Khumeria, Ahargondi, Baruband, Goruckpur, Lampta, Hareye, Partabgarh and Jamunpani, 29 miles.

Shortly after passing the village of Khumeria we entered the unreserved forest of Leriakhera. The first noticeable thing that we came across was a limekiln. One kiln at one burning yields about 3 cartloads of lime. For each cartload of lime the lessee pays 8 annas to Government, *i. e.*, Re. 1-8-0 for each burning of the kiln. The burning of one kiln consumes 4 cartloads of fuel, and, as the tax upon fuel (dry wood) in that forest is 2 annas per cartload, it amounts to this, that the lessee pays 8 annas for the wood, and Re. 1 for the lime. He however cuts green wood, while the two-anna rate is for dry wood. The limestone occurring in amygdaloid trap is a sort of kankar in rather large masses. In a heap of this limestone near the kiln we found two sorts of crystals at present undetermined.

Leaving the village of Ahargondi to our right, we passed through the forest tract of that name and noticed the following trees and shrubs:—teak; saj; dhaura; *albizzia odoratissima*, here called siris; chiula; salai; gurlu; *Butea parviflora*, called astu; dhobain; mohwa; tinsa; char; leria, aoura; ghato; seharu; bhilawa; ghatola; papra; kundru (*Casearia tomentosa*); tendu; gurar; ber; umerr; pakhur; kainkra; kohwa; yail or ail (*Acacia cæsia*); jaman and a few others.

A considerable portion of this area is in a most useless condition. As soon as we got above the narrow strip of low-lying land near the Dalta nala, where there is some teak and much open grass land, the only representative of a forest growth is salai, and that in no large quantity. Cattle are allowed to graze from the surrounding villages on payment of Rs. 10 per 100 heads, buffaloes, cows, bullocks, &c., all paying the same rate; but, though there is good water and plenty of grass in Ahargondi, the cattle of the neighbouring villages do not appear to penetrate far into the interior at this season. Much of this tract was burnt at the time of our visit, and doubtless the rest will speedily follow. A well-used track runs through this forest from north to south, and we met bullocks carrying grain on their way to Narsingpur.

Baruband, which lies to the south of Ahargondi, is a waste-land block of 4,648 acres and is marked W 3 in the Revenue Survey maps, made in 1866-67 on a scale of 4 inches = 1 mile. It is not, however, all forest. An area of 209 acres, situated in the valley of the Dalta nala, is cultivated, the fields being stocked with fine rabi crops at the time of our visit. The cultivators live in a village close by, which goes by the name of Baruband, but which is not indicated in the above-mentioned map. It appears that this is one of the 136 villages in the Seoni district which were not included in the settlement, *i. e.*, they were not given away in proprietary right, but were marked off as Government waste. In this particular case each cultivator holds an annual lease, which is renewed every year by the tehsildar of Lakhnadon, subject to the sanction of the Depnty Commissioner, the amount paid by each man being calculated according to the acreage he cultivates. For the year 1875-76 the total revenue from the village of Baruband was Rs. 172.

On our way from Baruband to Chapara, we passed through the villages of Goruckpur, Hareye, and Partabgarh. A considerable proportion of khair was noticed in the forests north of the junction of the Bijna and the Wainganga river.

II.—Gond names of a few of the principal trees.

Systematic names.	Hindi names.[1]	Gond names.	Remarks.
1. Dillenia pentagyna.	.....	Kallei.	Sâl forests of Maikal range, where it is called Mirchi by the Baigas. A small stunted tree, found in leaf only. There may possibly be also *Dillenia aurea* in these forests.
2. Flacourtia sapida.	Kakein.	Kakei.	
3. Kydia calycina.	.....	Kunji.	
4. Sterculia urens.	Kurlu, gurlu.	.....	
5. Grewia vestita.	Dhamin.	Dhamin.	
6. Aegle Marmelos.	Bêl.	Maika.	

[1] The names entered in the body of the report are generally those commonly used in the district where noted.

II.—Gond names of a few of the principal trees—continued.

Systematic names.	Hindi names.[1]	Gond names.	Remarks.
7. Boswellia thurifera.	Salei, saler,	Saleh.	
8. Garuga pinnata.	Kaikra, kainkra.	Gharri.	
9. Chloroxylon Swietenia.	Bhera.	Bhìra.	Bhìrwa (Baigas).
10. Soymida febrifuga.	Rohni, rohun.	Rohni.	
11. Zizyphus Jujuba.	Bēr.	Ringa.	Bor (Baigas).
12. „ xylopyra.	Ghattōl.	Ghōtia.	
13. Schleichera trijuga.	Kosum.	Kosum.	
14. Mangifera indica.	Am.	Marka.	Ama (Baigas).
15. Buchanania latifolia.	Chār.	Sareka.	
16. Semecarpus Anacardium.	Bhilāwa.	Khoka.	Bhilwa (Baigas).
17. Ongeinia dalbergioides.	Tinsa.	Tinsai.	
18. Butea frondosa.	Cheola, chiūla.	Murru.	Pharsa (Baigas).
19. „ superba.	.....	Badūri (Singrampur.)	
20. Dalbergia paniculata.	Dhobein.	Surteli.	Passi (Baigas).
21. Pterocarpus Marsupium.	Bija.	Bijo.	
22. Derris scandens.	Nās bel.	Golar.	
23. Cassia Fistula.	Jagarūa.	Raella.	Racila (Baigas).
24. Tamarindus indica.	Imli.	Chita.	Amli (Baigas).
25. Banhinia retusa.	.....	Thaur.	
26. „ Vahlii.	Maulein.	Paur bela.	
27. Acacia leucophlæa.	Reūnja.	Rinja.	
28. Anogeissus latifolia.	Dhawa, dhaura.	Arma.	Dhawa (Baigas).
29. Terminalia tomentosa.	Saj.	Maru.	Saja (Baigas).
30. „ Arjuna.	Kowah, kohwa.	Koha.	Kahu (Baigas). Anjan in the Wainganga valley.
31. „ bellerica.	Bahera.	Banjir.	
32. „ Chebula.	Harra.	Harro.	
33. Lagerstrœmia parviflora.	Sejo, leria (Gond?).	Lendya.	Lendya (Baigas).
34. Nauclea parvifolia.	Keim.	Mundi.	Mundi (Baigas).
35. Gardenia latifolia.	Papra.	Pania Billa.	Mali (Baigas).
36 Randia dumetorum.	.....	Katūl.	
37. Embelia robusta.	Baeberang.	Kopa Dulli.	
38. Bassia latifolia.	Mowah.	Irhu.	Mahū (Baigas).
39. Diospyros Melanoxylon.	Tendu.	Tumri.	Tendu (Baigas).
40. Schrebera swietenioides.	Ghato.	Karindi.	Ghattār (Baigas).
41. Nyctanthes Arbor tristis.	Scharu.	Kirsāri.	Kirsahār (Baigas).
42. Carissa diffusa.	Karaunda.	Karaunda,	
43. Cordia MacLeodii.	Deingan.	Ladhōr.	
44. „ Myxa.	Lessōra.	.....	Lassēri (Baigas).
45. Tectona grandis.	Sagauna.	Teka.	Sagūn (Baigas).
46. Gmelina arborea.	Sevau.	Kursi mara.	
47. Tetranthera monopetala.	.....	Kāri.	
48. Ficus religiosa.	Pipal.	Ali.	Pipur (Baigas).

[1] The names entered in the body of the report are generally those commonly used in the district where noted.

II.—Gond names of a few of the principal trees—concluded.

Systematic names.	Hindi names.[1]	Gond names.	Remarks.
49. Ficus bengalensis.	Bargat.	Bareli.	
50. „ glomerata.	Umer.	Toja.	Umar (Baigas).
51. Antidesma diandrum.	Amāri.	Masūr Bauri.	
52. Bambusa arundinacea.	.....	Kati Vadūr.	
53. Dendrocalamus strictus.	Bansh.	Veddar or Vadūr in the (Banjar valley).	

[1] The names entered in the body of the report are generally those commonly used in the district where noted.

The Gond names here given were carefully collected during this tour, and in most cases they were found to be the same on the hills south of the Nerbudda river in the Jabalpur district, as well as among the Gonds of the Seoni, Mandla, and Balaghat hills. The words *mara*, *teka*, *raella*, and others indicate the affinity between the language of the Gonds and the Dravidian (Kanarese, Telugu, and Tamil) languages of South India. Further enquiries will probably shew that many names of trees which are used in the Satpura Range, and which are commonly supposed to be Hindi, are of Gond origin.

The names used by Baigas were collected in the Balaghat hills. As is well known, the Baigas have no language of their own, but, as stated by Forsyth (*The Highlands of Central India*, p. 362), "they speak a rude dialect, of which almost every word can be traced to the Hindi." Thus, with few exceptions the names of trees used by them are Hindi, though they sometimes differ from the Hindi names in ordinary use in the district. Thus *Butea frondosa* is called by them "Pharsa" and *Dalbergia paniculata* "Passi," though the local (Hindi) names of these trees are "Chiūla" and "Dhobein."

These lists are published here by way of a commencement and to induce younger officers, with more leisure and more extensive opportunities, to take up the study of the names of trees and shrubs used by the hill tribes of Central India.

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